GREAT LAKES
MANAGEMENT PROBLEMS
SERIES

MANAGEMENT OF THE BIOLOGICAL RESOURCES OF THE LAKE ONTARIO BASIN

BY

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FOREWORD

One of the major tasks before us as we move into the end of the present century is bridging the gap that persists between the generation of new knowledge at a rate unmatched in human history and the effective application of this knowledge to pressing social and environmental problems. As population grows, industry and agriculture expand and resource consumption increases, the residuals of production and consumption place ever greater stresses on the physical environment. Nowhere is this more evident than in the Great Lakes Basin.

We in North America have reached that point at which environmental quality has taken its place in the arena of public issues. Citizens are now applying pressures on their governments as a means of defending certain values that had lesser priority in earlier days. While recognizing that a beginning has been made, the facts of the matter are that we are not managing well our natural resources and that progress will continue to be slow and halting unless the requisite political will for some fundamental changes emerges.

There are a number of common factors that account for our inability to respond more effectively to the challenges to managing not only our water and land resources, but other social problems as well. A listing of a few of the more significant factors affecting resource management include: the diffused public interest; differing views about national priorities; inadequate legislation and enforcement; special interest politics; fragmentation of responsibilities within and among governments; and organizational jealousies. These elements operate individually and jointly in ways that seriously impede public programs that are designed to yield effective management of our resources.

There is, however, a more fundamental contributive factor and that is our failure to modernize the institutional structure. The institutional problem is defined as that of determining what kinds of government organizations are needed and how these organizations should be related to each other in order to achieve the most effective management of the natural resources of the Great Lakes Basin at the lowest possible economic, political and social costs. There is, of course, an existing institutional apparatus involving all levels of government in both Canada and the United States. This present structure, however, is not the product of any United States - Canadian long-term plan for the Great Lakes Basin. On the contrary, the

present mix of governmental departments, agencies, boards and commissions simply evolved over the years at a rate and to an extent that were determined by the changing limits of political feasibility in each country.

For the past two years, the Water Resources and Marine Sciences Center at Cornell University has been engaged in a series of studies of the institutional problems in the Great Lakes Basin. Perhaps the most important conclusion of our studies is that the present institutional structure for resource management in the Great Lakes Basin is inadequate and is in need of fundamental revision.

The Cornell project focusing on the institutional problems of the Great Lakes consisted of three related yet distinct research efforts.

The first commenced in early 1971 when a group of twenty graduate students representing a wide range of disciplines investigated the water and related land management problems of the Lake Ontario Basin. The approach of this graduate seminar was to attempt a comprehensive, multiple resource-use investigation which included an examination of the social, economic and political factors peculiar to the Lake Ontario Basin. The objective of the group was to consider the need for, and the formulation of an improved management scheme for Lake Ontario. A background report (350 pages) was prepared and a summary report, The Management of Lake Ontario - A Preliminary Report Proposing an International Management Organization was distributed to the Governors and Provincial Ministers Conference on Great Lakes Environmental Problems at Mackinac Island, Michigan in July 1971.

The summary report concluded, among other things, that the improved management of Lake Ontario (and by extension, all of the Great Lakes) would require either a substantial strengthening of the International Joint Commission or the establishment of an altogether new binational agency to supplant the former in the Great Lakes Basin. The report recommended a joint Canadian - United States study in this matter and, as an interim action, a reference to the International Joint Commission authorizing the Commission to establish on a trial basis a management office with rather extensive coordinative responsibilities for the water and related land resources of the lower lakes region.

The graduate student group sought, in effect, a strengthened binational apparatus, preferably one based on the existing International Joint Commission, authorized to carry out a surveillance and mediation function in the lower lakes.

Surveillance is defined in this instance as essentially an information collection, data interpretation and dissemination role. It is an activity concerned with problem definition. Surveillance includes a continuing responsibility to be aware of problems and alert to future developments. Mediation, on the other hand, encompasses the development of joint programs to attack common problems. It involves also the promulgation of regulations, schedules and uniform standards, along with appropriate means to secure implementation of those regulatory mechanisms.

While some consideration might be given to assigning a joint agency a third function - that of control, particularly in the cases of water pollution or air pollution control, that does not appear to be a feasible direction in which to proceed, at least at the present time. The governments will be better able to determine their positions with respect to vesting a joint body with an effective control function once the Great Lakes Water Quality Agreement signed by Prime Minister Trudeau and President Nixon in April 1972 has had time to operate and be evaluated.

The second phase of the Cornell project began in late 1971. In order to further test the tentative findings of the graduate student group and also to encourage a binational focus on the problem, plans were laid for a six-month seminar comprised of interested faculty from universities in Canada and the United States.

A Canada- United States University Seminar was formed by various faculty from some twenty universities and colleges in Canada and the United States. The Seminar met in three formal sessions during the period December 1971 - June 1972. Using the information and data assembled by the Cornell graduate student group as a starting point, the Canada - United States University Seminar took up the question of improving the two countries' capabilities for managing the water and related land resources of the Great Lakes. A principal objective of the faculty group was to produce a report which would promote discussion in both countries on the problems of the Great Lakes. Another purpose was to set forth in general terms the available alternatives for improving the management of the water and related land resources of the Great Lakes Basin.

A final report of the Canada - United States University Seminar has been written and the findings (1) indicate that there is a need for a modified international arrangement to cope more effectively with the existing and emerging resource-use problems affecting the Great Lakes Basin, and (2) present three alternative institutional approaches as possible guides for further discussion and debate in

Canada and the United States.

The third phase of the Cornell research effort on the Great Lakes Basin consisted of an attempt to develop further the idea of a binational management office with wide coordinative responsibilities for the Lake Erie and Ontario Basins. Concurrently with the Canada - United States University Seminar (December 1971 - June 1972), a second graduate student group at Cornell University investigated, under the guidance of Professors Leonard B. Dworsky, C. Donald Gates and David J. Allee, selected elements of a hypothetical joint management office. As part of this effort, ten graduate students completed seven theses for advanced degrees, together with three research papers on some facet of a joint regional management office.

The type of joint office conceptualized is one designed to carry out a coordinative role in the management of a wide range of resource-use problems. The list of such problems used in the investigation included: water quality; municipal/industrial water supply; agricultural water supply; lake level control; hydropower; flood control; navigation; shoreline erosion; fish and wildlife protection; water-based recreation; solid waste disposal; air quality; economic development; agriculture and transportation.

In our attempt to simulate a Great Lakes operations office jointly established and operated by Canada and the United States, we endeavored to examine a selected number of those problems which both the designers of such an office as well as those who are ultimately charged with its direction would be obliged to address.

An obvious initial consideration, for example, would be the structure and functions of a modified joint agency. This topic is dealt with in Natural Resources Management in the Great Lakes Basin by James A. Burkholder. A primary task of an operations office would be the collection, interpretation and dissemination of data and information pertaining to the Basin. This important area is treated in An Information System for the Management of Lake Ontario by Dale Reynolds. The role of public participation in the activities of the proposed Basin operations office is examined in detail in Public Participation in Water and Land Management by Arvid L. Thomsen. Demographic trends and problems are traced on a national scale and then examined with respect to the Lake Ontario Basin as a case study in Toward a National Population Redistribution Policy: Some Policy Issues by Lawrence W. Saunders. The problems of

water quality management of a lake basin are considered in Opportunities for Water Quality Management: A Case Study of the Lake Erie Basin by Ralph P. Meckel. Special problems of environmental quality management along an international boundary are the subject of Environmental Management of the Great Lakes International Boundary Areas: A Case Study of the Niagara Urban Region by Donald R. Kisicki. The opportunities and problems associated with Federal and state grants for wastewater treatment facilities are discussed in two case studies in Cost Sharing in Water Pollution Abatement Facilities - Some Economic and Political Consequences by James M. Foster. Land use management as an integral part of the overall planning process is the subject of a paper Land Management in the Lake Ontario Basin by James M. Wolf. In his paper entitled Management of the Biological Resources of the Lake Ontario Basin, Douglas M. Carlson provides a comprehensive survey of the fishery, recreational and wildlife resources of the Lake Ontario Basin. Finally, in his paper Management of Water Supply, Navigation, and Power Programs, Martin J. Murphy focuses on those water uses in the Lake Ontario Basin and the potential role of a joint operations office with respect to municipal water supply, navigation and hydropower in a new institutional framework.

These papers, of which this by Douglas M. Carlson is one, are offered with the hope that they will contribute usefully to the improved management of the Great Lakes of Canada and the United States.

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ABOUT THE AUTHOR

Douglas M. Carlson majored in fishery science in the Department of Natural Resources at Cornell University. The New York Cooperative Fishery Unit sponsored his studies with a research assistantship during the 1970-1972 school years. In August 1972 he received his M.S. degree and is now employed as an aquatic biologist at the Brookhaven National Laboratory.

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Introduction

A huge resource shared by the United States and Canada, the Great Lakes, is being used by Americans and Canadians alike in an intensive way. My purpose in this paper is to look at and report on three major uses of one portion of that natural resource system, the Lake Ontario Basin. The report begins with a brief description of the characteristics of the Basin. The main report consists of three parts which deal with the fishery, outdoor recreation and wildlife, in that order. The physical boundaries of the study area include the entire lake drainage basin except for the Niagara River inflow. In the analysis of the sport fishery, outdoor recreation and wildlife, these boundaries are extended along the St. Lawrence River to Cornwall, Ontario because of the extensive recreational use of that region.

Physical and Biological Characteristics of the Lake Ontario Basin

Lake Ontario has the smallest surface (Table 1) and the second smallest drainage basin (27,200 sq. mi.), yet the U.S. Bureau of Outdoor Recreation (B.O.R.) (1967) describes it as having the greatest range and variety of natural recreation resources in the Great Lakes system. It is a glaciated lake basin with an average water depth of 91 m and surrounded by lowlands except on its eastern end. The Lake Ontario Basin accounts for only 16% of the annual water budget, the rest contributed by the other four lake basins (Table 2). The Niagara River and Welland Canal at Queenston, Ontario, have a mean annual flow into Lake Ontario of 202,000 cubic feet per second (CFS) and the St. Lawrence River has an outflow of 232,000 CFS at Cornwall, Ontario. The retention time for lake water is 7 1/2 years (Table 3). The lake undergoes one isothermal period (winter) and one stratified period (summer) in each annual cycle. The factors affecting lake circulation are wind mixing, density-temperature differences, barometric pressure differences, and inflow changes, wind mixing being the most important factor. The U.S. portion encompasses 44% of the water surface and 56% of the land drainage (Table 1).

The mesotrophic open waters of Lake Ontario show little impairment in quality from chemical pollutants. Allen (1969) reported that in 1964 there were no areas of serious oxygen depletion, yet Hurley (1971) describes recent late summer oxygen deficits in the Bay of Quinte. Analytical data on water chemistry are presented in Table 4. The accelerated eutrophication of Lake Ontario is suggested by the long term increase in dissolved solids (Table 5).

The most significant changes in water quality in the basin drainage are evidenced in the tributaries and shoals. The early destruction of the Atlantic salmon fishery and present day depression of the lake fishery is largely credited to man's misuse of these tributaries. Lake Ontario has had the lowest commercial fish harvest of all the Great Lakes since 1885 (Table 6). More recent reports (1946 and subsequent) show Lake Ontario with a low but stable fish harvest compared to the other Great Lakes (Figure 1). Since 1930, the lake has also had the lowest per acre fish harvest of all the Great Lakes (Figure 2). There are no data comparing intensity of fishing effort in the various lakes, but the presence of early population centers around the lake probably resulted in greater fishing intensity in that basin.

Figure 3 indicates the current pollution problem areas of the Ontario Basin tributaries within New York State. Table 7 lists the larger rivers of the Basin that are degraded by human effluents. The New York portion of the Basin includes about 28,000 miles of streams (Figure 4) and the Ontario streams are shown in Figure 5.

Marshes and estuaries of Lake Ontario are confined to small harbors areas in the western third of the lake, to larger harbor areas and marshy embayments eastward to Oswego, N.Y., and from Oswego to the St. Lawrence River in areas with shallow marsh embayments and rough irregular shorelines. Few, if any, urban centers are located on these areas, and cottages and cabins cause whatever water quality problems there are. Christie (1971) also reports:

> "There are approximately 28,290 acres of shoal water less than six feet in depth throughout the 290-mile reach of Lake Ontario shoreline. About 16,000 acres flank the open-lake beach; 1,980 acres are offshore island shoals; and 5,000 acres support submerged and emergent vegetation. Landward of the shoreline, there are approximately 18,400 acres of marsh and shrub land, flanking cutoff embayments and delta areas. These are located primarily along the east two-thirds of the lake. Marsh areas range in size from 65 to 3,500 acres on any one estuarine area."
>
> "Estuary bottoms consist primarily of silt, sand and gravel with boulders, bed and shattered rock becoming more dominant toward the St. Lawrence River outlet."
>
> "The estuarine zones provide spawning, nursery, and growth development habitat for the Lake Ontario fish resource. Waterfowl use the estuarine areas for migration, resting, feeding, and nesting."

The shorelines are generally steepsided clay banks and sand beaches are scarce with only 35 miles of this type of shoreline, or 63 acres of sand beach, on the south shore (the regions are indicated on Figure 6). Most of the sloping beaches on the northern shore are located in the northeast region between Brighton, Ontario and Stoney Point, N.Y. where 72% of the total lake shoreline is found.

Inland lakes are also an important component of the water resource of the Lake Ontario basin. New York's 762 inland lakes include the deep oligotrophic Finger Lakes, Oneida Lake, hundreds of Adirondack lakes and ponds, and many artificial reservoirs. The total surface area is 331,520 acres (B.O.R., 1967). The lakes of the Province of Ontario are less numerous, with most located in the eastern half of the basin (Figure 5).

Soil types are notably different on the north and south portion of the basin. Ontario soils are primarily deep sands and gravels along water boundaries with hilly, sandy and rolling loam soils throughout most of the rest (Figure 7). New York soils of the Lake Ontario Basin are generally more diverse. The lake plains soils of New York are a

combination of sedimentary deposits and limestone mixed with glacial till (Figure 6). Soils along the St. Lawrence River are more rocky and swampy and less productive agriculturally. The soils of the glaciated plateaus are stoney and generally poor. Agricultural land use in the Ontario portion of the Basin accounts for about 26% of the land, and agriculture is most intense in Prince Edward and the four western-most counties (Figure 8). Agriculture in the New York portion is most intense in the central, southern region (Figure 9) and occupies 42-48% of the land (LUNR 1969, and Table 8).

Dairy farming is the predominant New York agricultural land use, with grain, vegetable, and fruit crops also being produced in many regions. The Ontario portion of the Basin produces primarily fruit crops (tree fruit and grapes), vegetables (potatoes), grain (wheat), hay, and some dairy products.

Land ownership is very different between the north and south portions of the Basin. The New York lands are 4% public and 96% private, while Ontario lands are about 5 % public. Ontario public ownership in the Basin (the Canadian portion of the Basin constitutes 2% of the area of the province) is much less than in the whole province (90% public); and these public areas outside the basin are within close driving distance.

The natural vegetative patterns of the Lake Ontario basin were greatly altered by man, and this has had a measurable effect on surface runoff and land erosion. Thousands of acres of productive and fragile lands have been lost to industrial and urban development. The predominant vegetation in the remaining natural areas are broad leaf deciduous trees including oaks, hickories, maples, yellow poplar, beech, birch, and some coniferous spruce and fir.

A very important characteristic of the Lake Ontario Basin is the distribution and concentration of people. Over two-thirds of the population on both sides of the lake live in urban areas, and urbanization is increasing. The greatest concentration is in the western arc, extending from Oshawa, Ontario to Buffalo, New York (Figures 10 and 11). The 1968 population of the Lake Ontario Basin was 6.1 million (2.3 million U.S. and 3.8 million Canadian), and there were 0.15 million more living in the St. Lawrence River region (Dworsky, Gates, and Allee 1971). Sixty-two percent of the 1960 Canadian population were located between Quebec City, Quebec, and Windsor, Ontario (Krueger Sargent et al. 1963); and the Toronto-Hamilton-Niagara Falls region constitute a major portion of this populace. The population concentrations in the United States are distributed more widely, and the New York portion of the lake basin contains only 1% of the 1969 nation's population. Growth centers are located at Buffalo, Rochester, Oswego and Syracuse.

Table 1. Hydrologic Data for the Great Lakes System

Item	Unit	Lake Superior	Lake Michigan	Lake Huron	Lake St. Clair	Lake Erie	Lake Ontario
Areas							
Water surface, United States	sq. mi.	[1] 20,700	[2] 22,300	[3] 9,100	[4] 198	4,980	[5] 3,600
Water surface, Canada	do.	[1] 11,100	—	[3] 13,900	[4] 292	4,930	[5] 4,000
Drainage basin land, United States	do.	[1] 16,700	[2] 45,600	[3] 16,200	[4] 2,850	18,000	[5] 15,200
Drainage basin land, Canada	do.	[1] 31,500	—	[3] 33,400	[4] 4,080	4,720	[6] 12,000
Drainage basin land, Total	do.	[1] 48,200	[2] 45,600	[3] 49,600	[4] 6,930	22,700	[6] 27,200
Drainage basin (land and water) Total	do.	[1] 80,000	[2] 67,900	[3] 72,600	[4] 7,420	82,600	[5] 94,800
General hydrologic data							
Average annual precipitation [7]	inches	29.45	31.08	31.14	[8]	33.69	34.10
Average annual evaporation [7]	do.	21	[9]	[9] 26	[8]	33	28
Average annual natural outflow [7]	cfs	71,000	[9]	181,000	[8]	203,000	237,000
Average annual natural outflow [7]	bgd	46	[9]	117	[8]	131	153
Average annual natural gain [7]	bgd	46	[9]	[9] 71	[8]	14	22
Highest monthly mean elevation [7]	ft. IGLD [10]	602.06	581.94	581.94	[11] 575.70	572.76	248.06
Lowest monthly mean elevation [7]	do.	598.23	575.35	575.35	[11] 569.86	567.49	241.45
Mean elevation [7]	do.	600.57	578.69	578.69	[11] 575.00	570.36	244.77
Average seasonal fluctuation	feet	1.0	1.0	1.0	1.7	1.2	1.5

[1] Including St. Marys River above Falls.
[2] Lake Michigan including Green Bay.
[3] Including St. Marys River below Falls, North Channel, and Georgian Bay.
[4] Lake St. Clair and St. Clair and Detroit Rivers.
[5] Lake Ontario including Niagara River and St. Lawrence River to Iroquois Dam.
[6] Period 1860-1966.
[7] Included as part of Lake Erie.
[8] Lakes Michigan-Huron as single unit because of common outlet.
[9] Period 1900-1964.
[10] International Great Lakes Datum.
[11] Period 1898-1966.

Source: U.S. Water Resources Council
The Nation's Water Resources (1968)

Table 2. Percentage of Total Discharge of the Great Lakes Contributed by Individual Lake Basins

Basin to which discharge is contributed	Lake Basin Contributing Discharge				
	Superior	Michigan	Huron	Erie	Ontario
Superior	100	-	-	-	-
Michigan	-	100			
Huron	41	31	28		
Erie	37	28	25	9	
Ontario	31	24	21	8	16

From Anderson (1969)

Table 3. Hydrology of the Great Lakes

Lake	Water surface (percent of total water-shed	Mean discharge (CFS)	Volume (cubic) miles)	Retention time (years)	*
Superior	40	73,300	2,935	189	186
Michigan	33	55,000	1,170	99.1	111
Huron	32	177,900	849	22.3	22
Erie	31	195,800	110	2.6	2.5
Ontario	22	233,900	393	7.8	7.5

*Anderson (1969)

From Great Lakes Basin Framework Study

Table 4. Water Chemistry in Regions of the Great Lakes

	Superior	Michigan	Huron	St. Clair	Erie	Ontario
Hardness in ppm	46	98*	109	123*	130*	
Iron in ppm	0.06	0.14*	-	0.21*	0.13*	
Alkalinity in ppm	62	81	90	100	98	
pH	8.5	8.2	8.3	8.5	8.0	
Sulphate in ppm	4	13	17	15	23	
Potassium in ppm	1.7	2.4	4.9	9.1	10.8	
Magnesium in ppm	3.0	6.4	8.6	7.8	7.9	
Carbon Chloroform Extract in ppm(CCE)		50	100	100	125	
Fluoride in ppm	0.03	0.03	0.04	-	0.05	
Conductivity in uMhos	1.04	212	224	325	328	
Chloride	2.5	5.7	8.2	26	27	

Notes:

1. All of the above figures are averages and are of the order of magnitude accuracy only.
2. Most samples were taken from littoral regions or from shoreline intakes. Asterisks * represent mid-lake samples.
3. The most recent data compare favourably with those collected in 1948.
4. The term "carbon chloroform extract" represents organics adsorbed from the water by means of carbon filters extracted with chloroform and analyzed by infrared spectrophotometry. It does not represent all organics but only the neutral fraction which dissolves in chloroform. The neutrals are usually the culprits in taste and odour problems. Since little information of value is obtained by analyzing for the acid and alkaline fractions, and the procedure is time-consuming (5 to 6 days), examination is restricted to the neutral fraction only, which is usually the major portion of the organics present. (From a letter from A.J. Harris, Director, Division of Research, Ontario Water Resources Commission.)

From Anderson (1969)

Table 5. Total Dissolved Solids (ppm) in the Great Lakes Since 1906

Lake	1906-1907	1934-1943	1954	1955	1956	1959	CHANGE
Superior	60	60	59				-1
Huron	108	114				134	+26
Michigan	118			150			+32
Ontario	134	161		165			+31
Erie	133	165			171		+38

Note that the Lakes changing the most are those surrounded by the greatest concentrations of human population. The chemical constituents of the Great Lakes waters is affected, not only by the human population concentration, but also by the geological ages of the Lakes, the types of rock in the several watersheds, the amount of leaching going on in the watersheds, and the amount of erosion products arriving in the lakes from the watersheds. Except for Lake Superior, the aging of the Lakes must be attributed mainly to man.
(Ayers: Great Lakes Basin, p.87.)

From Anderson (1969)

Table 6. Total Catch (thousands of pounds) of All Fish Species from the Great Lakes

Year	Lake Ontario	Lake Erie	Lake St. Clair and connecting waters	Lake Huron	Lake Michigan	Lake Superior	Total
1879	6,878	30,647	2,819	11,402	23,142	4,169	79,057
1880	-	-	-	-	-	-	-
1881	-	-	-	-	-	-	-
1882	-	-	-	-	-	-	-
1883	-	-	-	-	-	-	-
1884	-	-	-	-	-	-	-
1885	6,602	59,142	-	21,593	23,485	10,468	121,290
1886	-	-	-	-	-	-	-
1887	-	-	-	-	-	-	-
1888	-	-	-	-	-	-	-
1889	7,525	73,189	2,493	27,149	26,007	10,067	146,430
1890	7,535	73,648	3,210	24,520	26,434	8,059	143,406
1891	-	-	3,748	24,921	-	-	-
1892	-	-	3,053	26,467	28,039	-	-
1893	4,598	52,548	-	26,128	40,723	10,214	134,211
1894	-	-	1,797	24,615	42,728	-	-
1895	-	-	1,182	23,971	38,212	-	-
1896	-	-	1,415	22,668	47,004	-	-
1897	3,674	44,607	1,226	19,145	39,634	8,410	116,156
1898	-	-	1,110	21,478	-	-	-
1899	5,071	68,975	1,087	24,597	37,547	9,340	146,617
1900	-	-	1,063	21,603	-	-	-
1901	-	-	977	24,436	-	-	-
1902	-	-	1,061	28,050	-	-	-
1903	3,754	29,340	1,027	26,907	36,623	16,399	114,050
1904	-	-	1,133	27,464	-	-	-
1905	-	-	1,834	25,122	-	-	-
1906	-	-	1,813	24,937	-	-	-
1907	-	-	1,606	25,068	-	-	-
1908	4,016	53,212	1,477	20,718	47,356	12,487	139,266
1909	-	-	1,174	-	-	-	-
1910	-	-	620	-	-	-	-
1911	-	-	1,065	-	26,493	-	-
1912	-	-	971	20,937	24,814	-	-
1913	3,361	-	1,044	18,074	27,091	12,818	-
1914	4,320	71,274	2,710	15,354	28,201	15,989	137,848
1915	5,170	76,313	1,991	18,980	31,642	17,760	134,856
1916	5,597	53,818	1,227	26,607	21,984	13,981	123,214
1917	6,228	61,429	1,285	20,342	31,674	15,564	136,522
1918	5,567	70,974	980	21,831	27,708	19,287	146,347
1919	6,048	49,293	1,169	21,861	23,922	14,823	117,116
1920	5,318	49,044	1,527	17,865	19,999	12,622	106,375
1921	6,491	63,126	1,071	16,044	21,978	9,986	118,696
1922	5,497	58,583	1,309	20,471	19,394	9,182	114,436
1923	5,788	62,149	880	16,943	15,380	12,173	113,313
1924	5,968	59,249	951	16,202	18,316	12,726	113,412
1925	4,696	37,640	621	20,254	21,341	16,119	100,671
1926	4,906	33,807	630	20,667	20,494	18,026	98,530
1927	4,429	33,862	515	24,603	23,679	20,781	107,869
1928	4,330	30,056	517	17,836	17,998	18,820	89,557
1929	4,557	29,905	324	16,319	26,186	21,421	98,712
1930	4,703	42,264	481	22,189	26,962	19,627	116,226

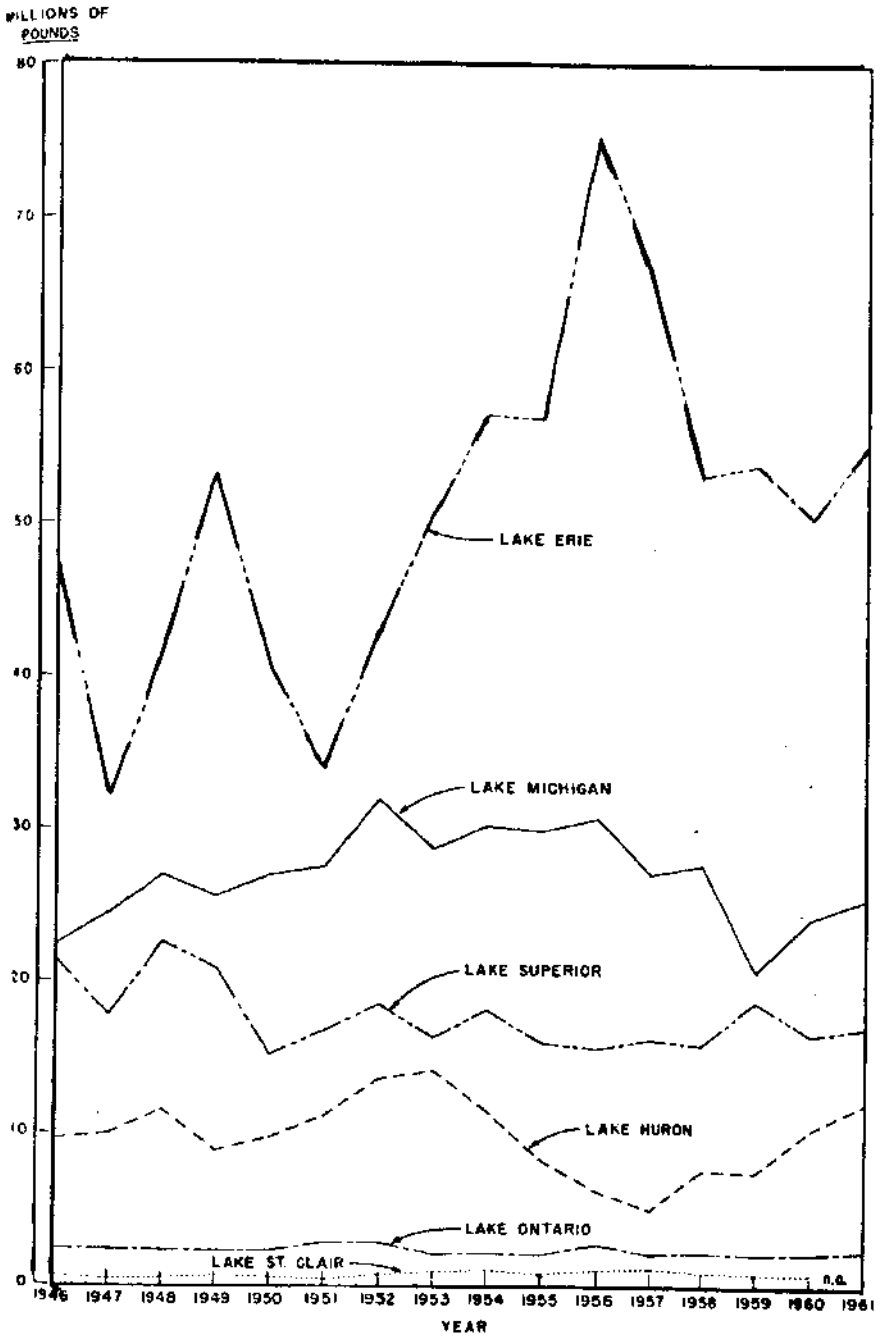
From Baldwin and Saafeld, (1962)

Table 6. (continued)

Year	Lake Ontario	Lake Erie	Lake St. Clair and connecting waters	Lake Huron	Lake Michigan	Lake Superior	Total
1931	3,310	48,806	714	23,706	24,374	14,427	115,137
1932	2,754	46,494	701	22,903	19,305	12,857	105,014
1933	3,078	35,351	756	21,279	21,002	13,739	95,205
1934	2,948	43,598	959	21,935	26,055	21,608	117,103
1935	3,493	44,726	777	22,036	24,432	21,450	116,914
1936	3,727	46,702	721	20,548	24,478	20,908	119,354
1937	3,948	41,590	850	19,438	25,602	20,521	111,949
1938	3,758	42,120	773	19,324	24,101	18,913	108,989
1939	4,951	42,927	959	19,777	22,448	20,090	111,152
1940	4,381	32,711	956	14,671	22,601	23,991	99,311
1941	3,724	31,013	1,176	14,150	22,931	25,547	98,541
1942	2,813	34,168	673	13,244	21,413	22,590	94,901
1943	2,707	41,598	540	13,028	22,175	21,719	101,767
1944	3,037	44,092	619	9,925	19,252	23,006	99,931
1945	2,830	47,580	647	10,504	22,090	22,537	106,188
1946	2,442	48,046	654	9,683	22,392	21,437	104,654
1947	2,465	32,152	571	10,074*	24,958	17,817	88,037
1948	2,431	41,428	630	11,634	27,023	22,592	105,738
1949	2,357	53,342	768	8,953	25,573	20,919	111,912
1950	2,408	40,848	664	9,835	27,078	15,239	96,072
1951	2,908	34,065	477	11,264	27,648	16,886	93,248
1952	2,950	42,768	819	13,646	32,061	18,592	110,836
1953	2,256	50,736	1,039	14,227	28,834	16,420	113,512
1954	2,225	57,252	1,120	11,571	30,291	18,275	120,734
1955	2,176	57,080	892	8,356	30,036	16,121	114,661
1956	2,807	75,426	1,141	6,398	30,798	15,736	132,306
1957	2,203	66,811	1,273	5,185	27,223	16,361	119,056
1958	2,361	53,326	1,093	7,780	27,771	16,065	108,396
1959	2,277	54,030	966	7,641	20,808	18,806	104,528
1960	2,216	50,477	797	10,251	24,311	16,599	104,651

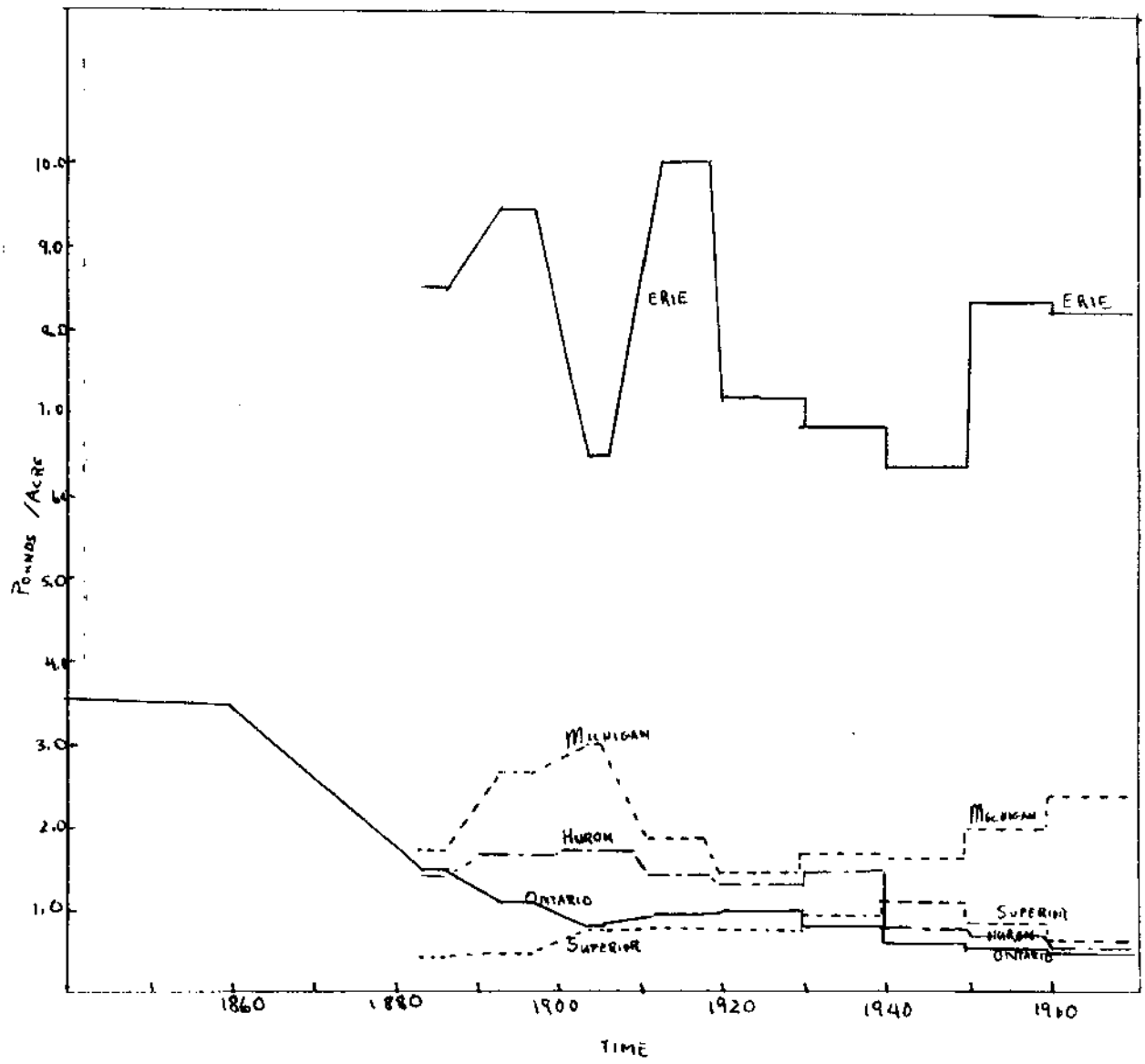
From Baldwin and Saafeld, (1962)

Figure 1. Great Lakes Fish Landings of All Species, by Lake, 1946-1961



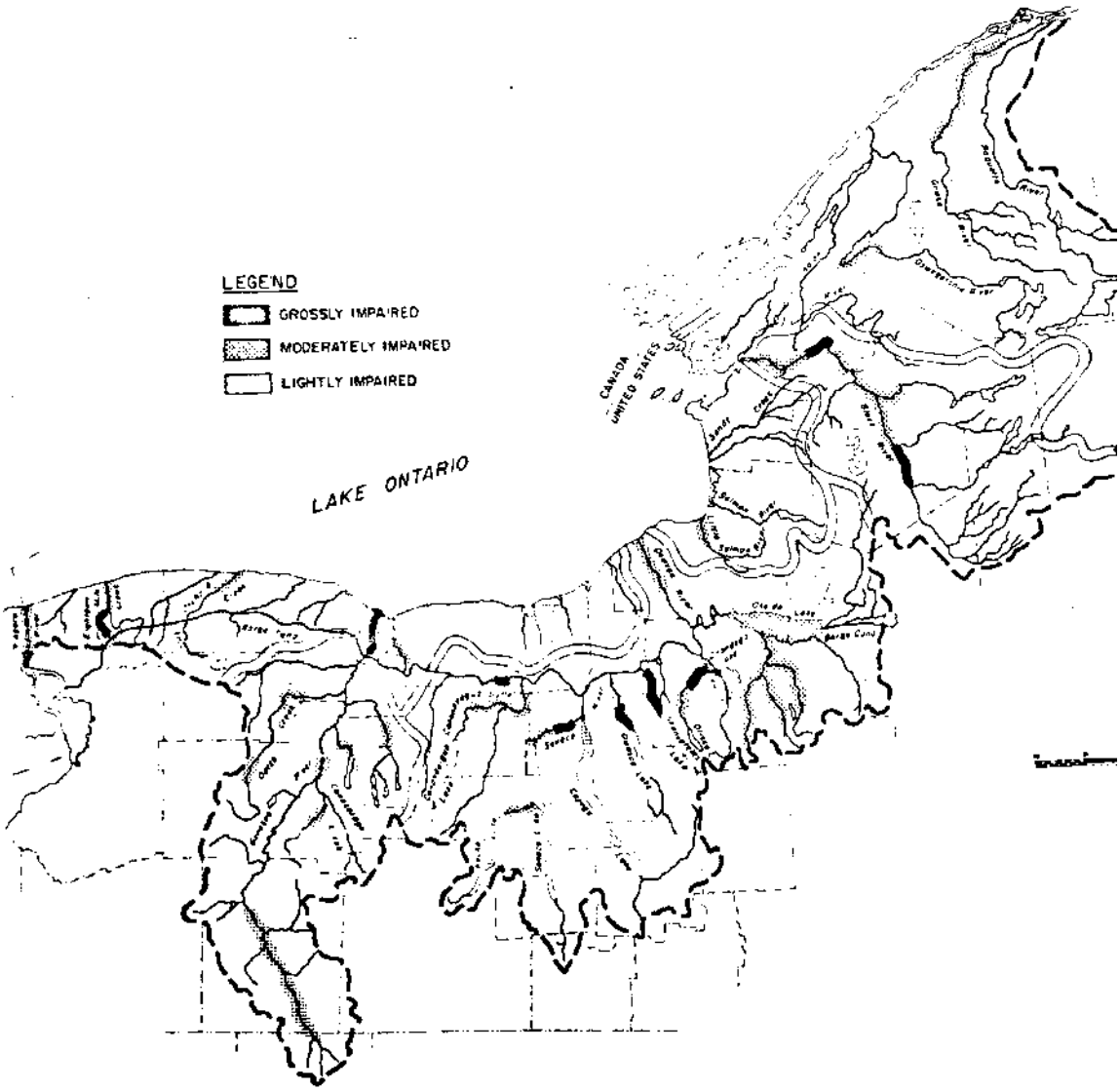
From Frick (1965)

Figure 2. Average Pounds Per Acre Produced by the Commercial Fishery of the Great Lakes for Various Time Intervals and Years of Record



Extracted from Smith (1971 MS)

Figure 3. Location of Recreational Waters in the Southern Portion of the Lake Ontarion Basin Impaired by Low Quality



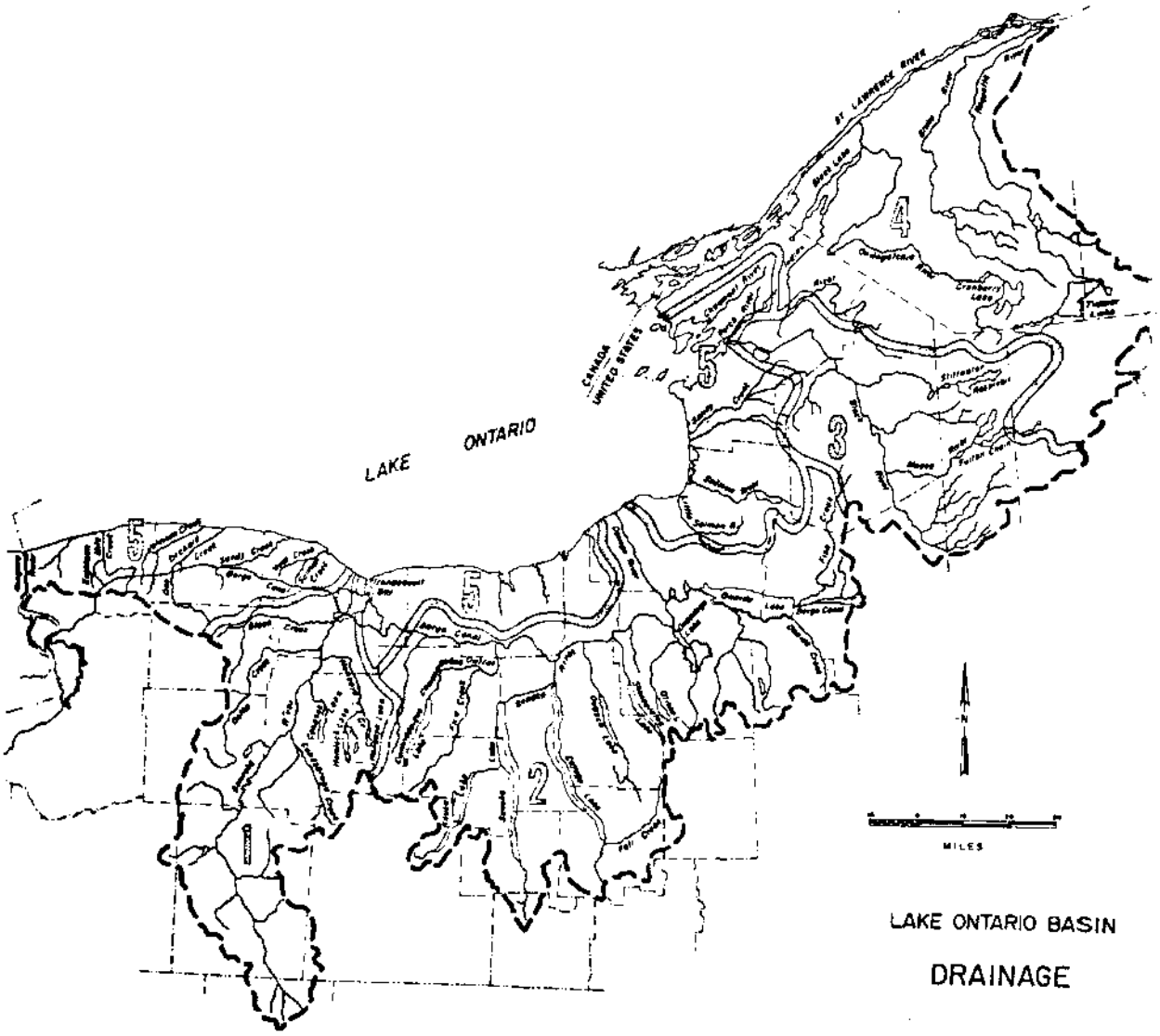
From Department of the Interior
Bureau of Outdoor Recreation (1967)

Table 7. Major Rivers and Connections Entering Lake Ontario

River	Enters (leaves) at	From
12. Lake Ontario		
Trent River	Bay of Quinte, north shore Lake Ontario	Balsam, Scugog, Sturgeon, Blackhorn, Pigeon, Chemong, Stoney, Clear and Rice Lakes, Ottawa, Rideau River
Rideau Canal	Kingston	
Black River	East shore at Dexter	
Oswego River	Oswego, South shore Lake Ontario	Seneca River and Oneida Lake
Genesee River	Rochester	
Humber River	West of Toronto, north shore Lake Ontario	
Don River	Toronto, north shore	

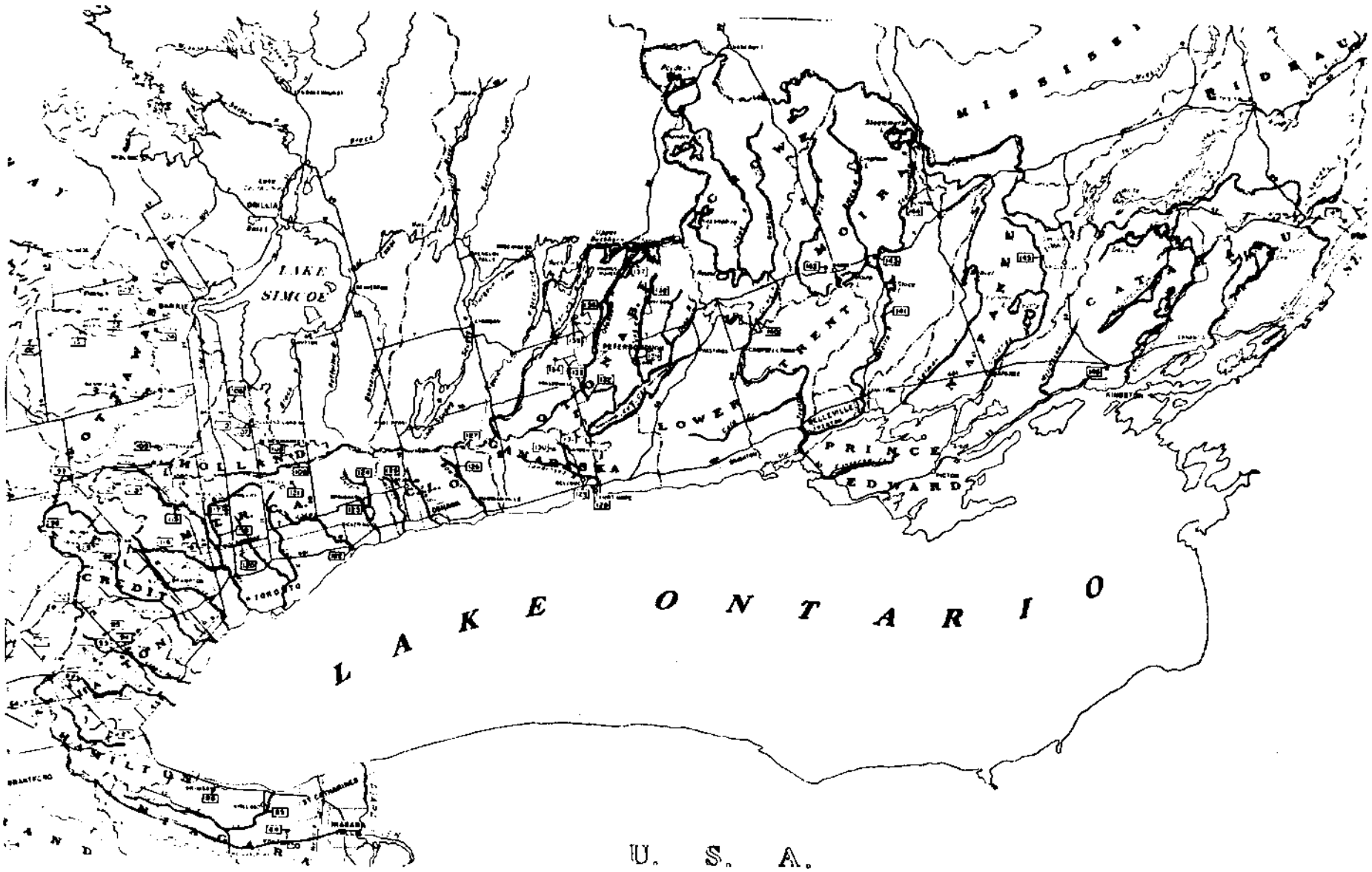
From Anderson (1969)

Figure 4. Major Rivers and Lakes of the Southern Portion of the Lake Ontario Basin



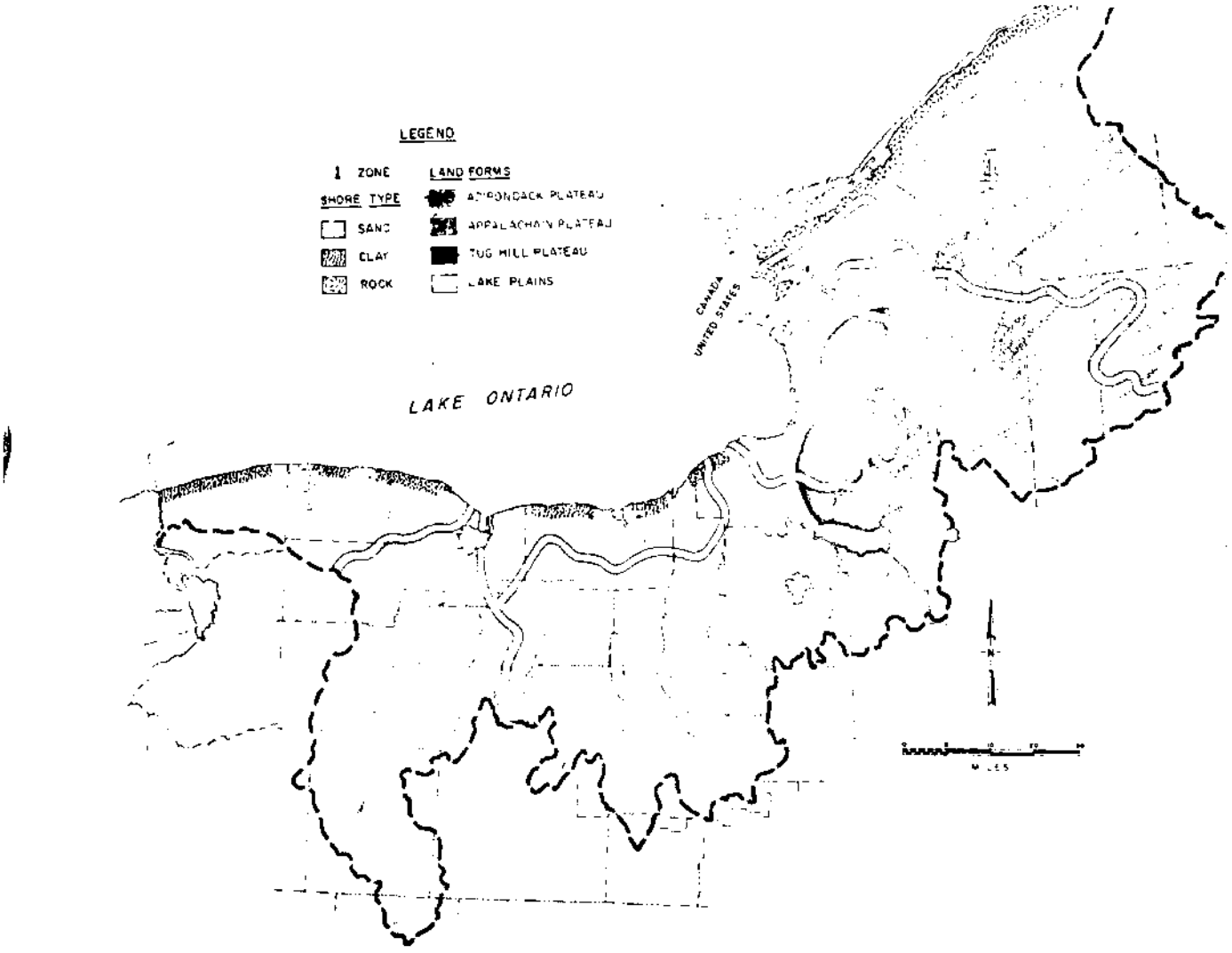
From Department of the Interior
Bureau of Outdoor Recreation (1967)

Figure 5. Major Rivers and Lakes of the Northern Portion of the Lake Ontario Basin



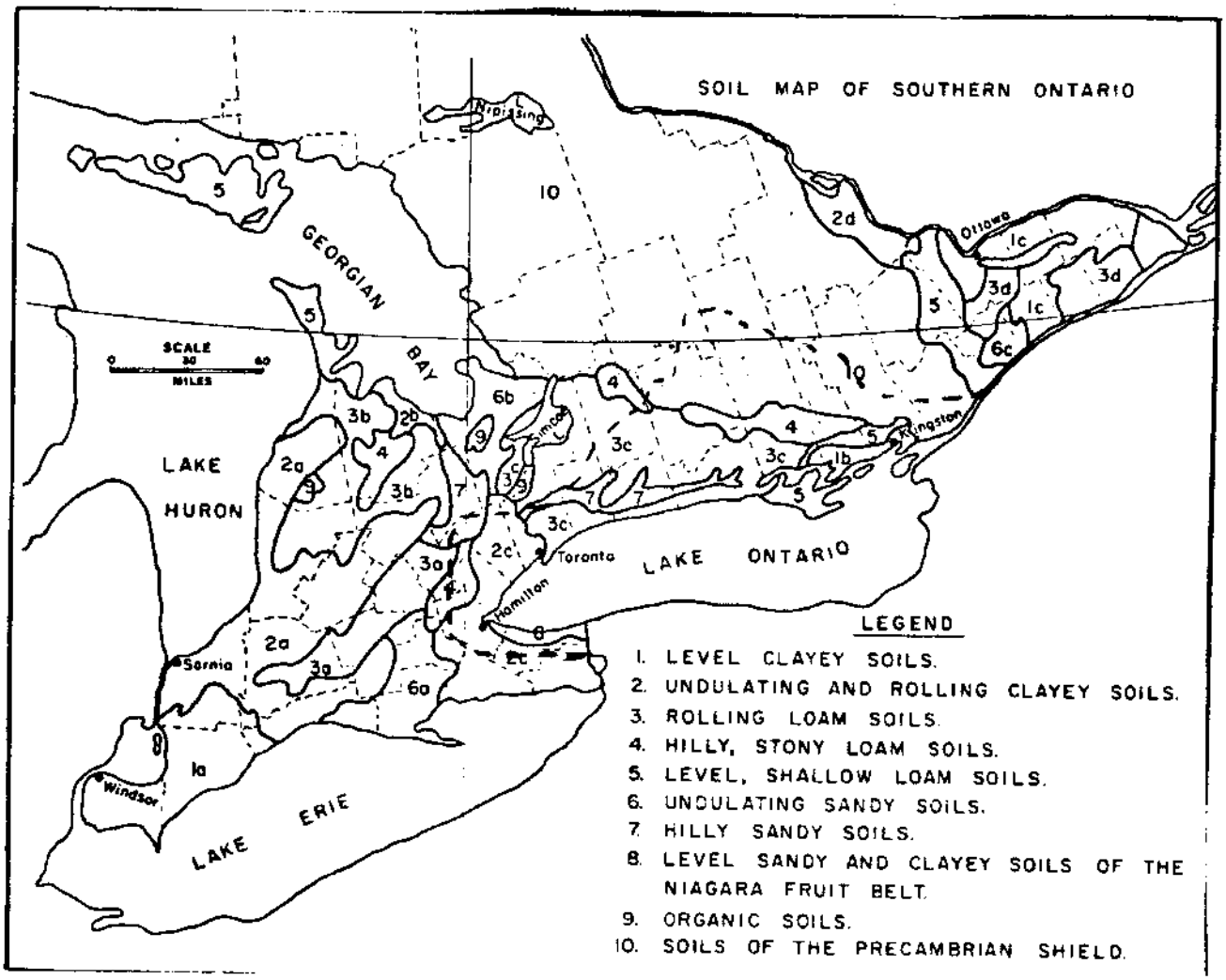
From Ontario Dept. of Energy and Resource Management

Figure 6. Major Land Forms and Shore Types of the Southern Portion of the Lake Ontario Basin



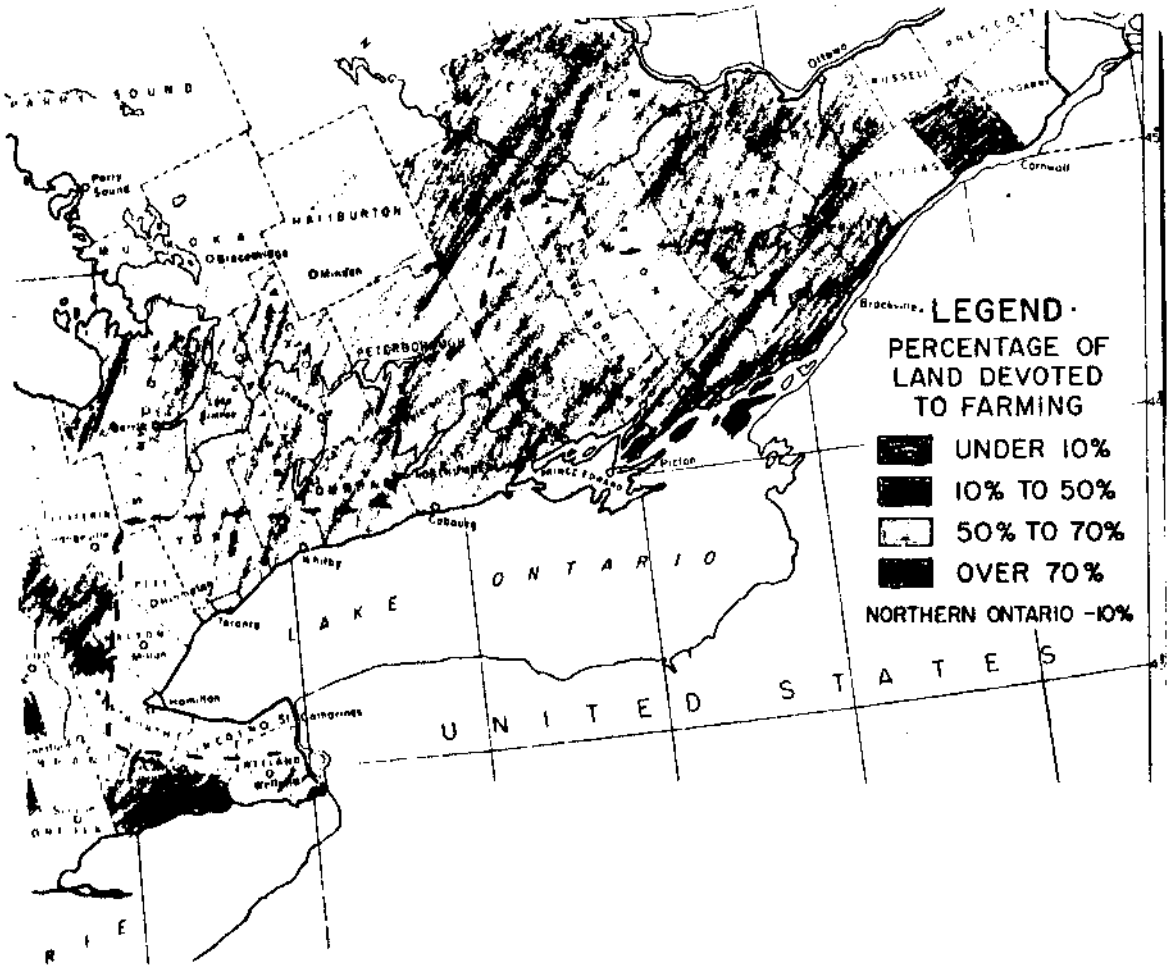
From Department of the Interior
Bureau of Outdoor Recreation (1967)

Figure 7. Soil Map of Southern Ontario



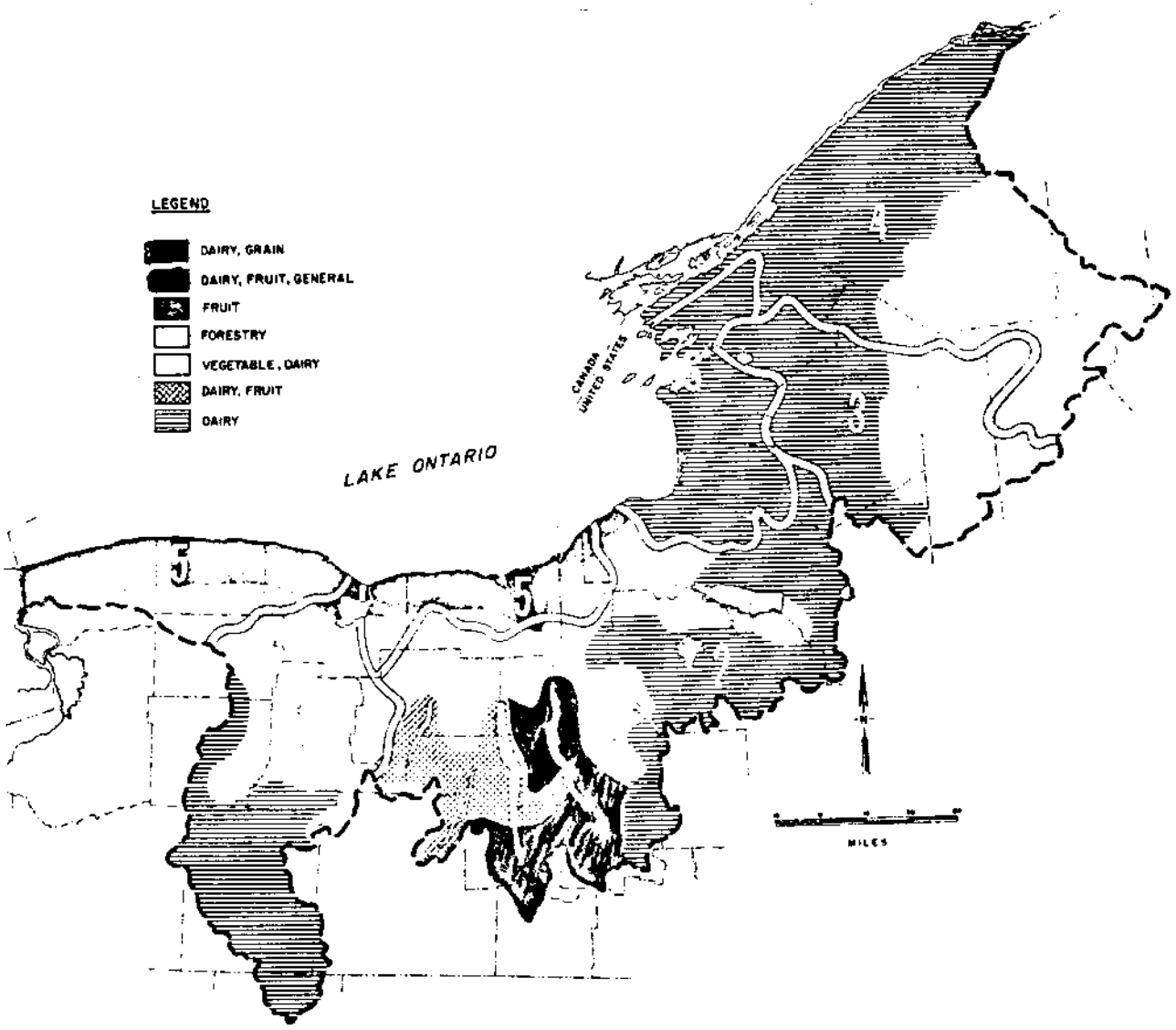
From Weeber and Hoffman

Figure 8. Agricultural Land Use in Southern Ontario, 1961



From Ontario Dept. of Lands and Forests (1963)

Figure 9. Agricultural Land Use in the Southern Portion of the Lake Ontario Basin



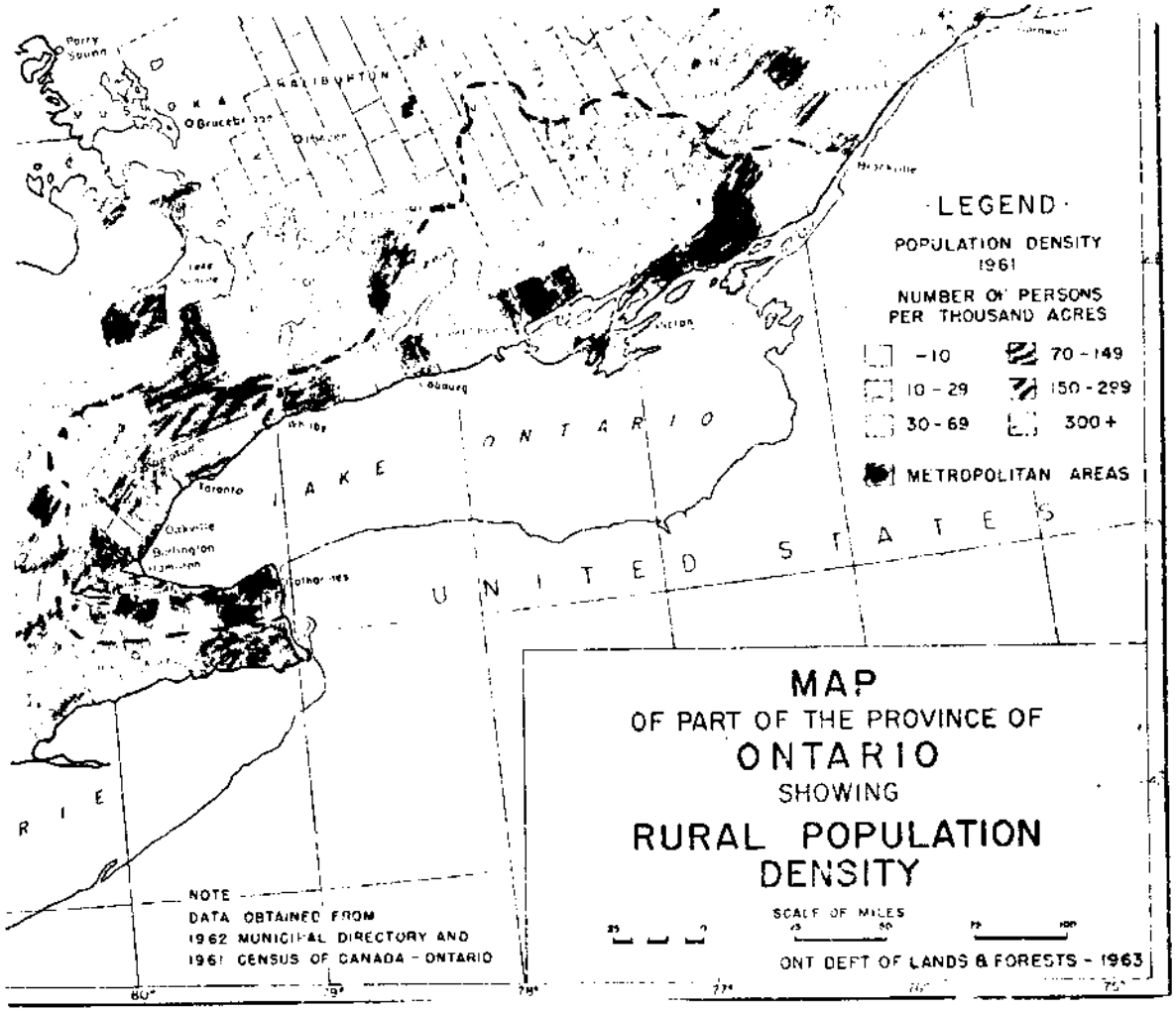
From Department of the Interior
Bureau of Outdoor Recreation (1967)

Table 8. Agricultural Land Use on the Lake Ontario Basin

Land Use	Canada acres	%	United States acres	%
Crop	1,432,000	71	3,090,000	65
Fallow and other	46,000	2	457,000	10
Pasture	542,000	27	1,171,000	25
Total in Agriculture	2,020,000	26	4,718,000	48
Total in Basin	7,680,000		9,728,000	

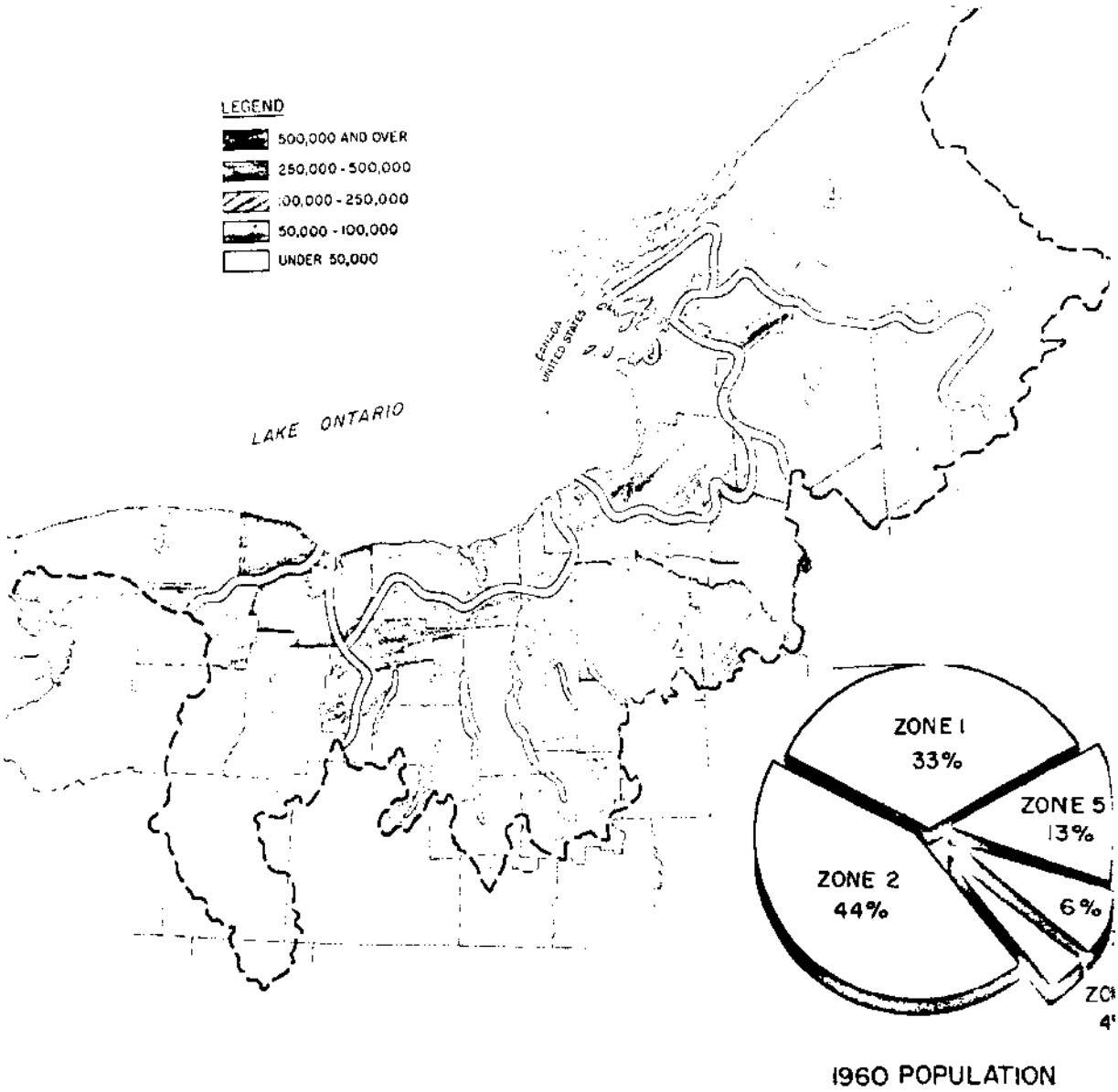
From Dworsky, et al.(1971)

Figure 10. Population Distribution in Southern Ontario, 1961



From Ontario Dept. of Lands and Forests (1963)

Figure 11. Population Distribution in the Southern Portion of the Lake Ontario Basin, 1960



From Department of the Interior
Bureau of Outdoor Recreation (1967)

Literature Review of Lake Ontario Biota

Investigations on the biota and environmental changes in the Great Lakes in the last decade have made great contributions to establishing a firm base of ecological information for these rapidly changing ecosystems. Lake Ontario has experienced some stablility in the last 40 years, and plans for studying and restructuring the system are becoming realities. Beeton (1969) describes Lake Ontario as having characteristics associated with both eutrophic and oligotrophic conditions. A major work by Sweers (1969) describes the dynamics of Lake Ontario. Rates of change for specific ions in the water are greatest for chlorides and sulfates - trends similar to Lake Erie (Beeton 1965). Davis (1968) emphasizes the importance of the spread of the green algae Cladophora which proliferates in shallow waters. The most recent significant phytoplankton studies are Tucker (1948) and McCombie (1967) for the Bay of Quinte; Schenk and Thompson (1965) for the Toronto water supply, and Nalewajco (1966, 1967) for the open waters of the lake. Changes in the benthos of Lake Ontario are reported by Brinkhurst (1968) and Hiltunen (1969). An interesting study on zooplankton successional changes in Lake Erie is described by Brooks (1969). Lake Ontario zooplankton were studied by Patalas (1969), Anderson (1969), and Clayton (1959). Fishes of Lake Ontario have changed radically in the last century, and present stocks are very low in numbers. Smith (1971 ms and 1968) and Christie (1971 ms and 1972 ms) summarize some of the changes and discuss species relationships.

Exploratory studies to estimate present fishery stocks in open waters include those by Wells (1969) and Christie (1971). Recent studies on the important fishes lamprey, alewife, and white perch, are reported by Lawrie (1970); Smith (1970) and Wagner (1972); and Scott and Christie (1963).

PART ONE

Fisheries of the Lake Ontario Basin and the Activities of the Great Lakes Fishery Commission

The commercial fishery harvest of Lake Ontario has always been low in comparison with the other Great Lakes of North America, and the present day fishery must be considered the most impoverished of the five lakes (Christie 1972 ms). Tendencies characteristic of eutrophication in the last 50 years have accompanied the markedly changing composition and abundance of plants and animals in the lake. Total aquatic production may have increased over the last several decades, but the quality of the harvestable production has decreased drastically.

The remnants of the once flourishing fishery businesses range from dying to modest to successful. Only a small portion (about 10% according to Pearce, 1972) of the lake contributes to the harvest and the productive shoal areas are showing stress. The future of this resource lies in the hands of the binational Great Lakes Fishery Commission and hundreds of private and public vested interests. Until the managers and harvesters come to agreement on policies and practices in using Lake Ontario, the fishery will continue in its relatively unproductive state or perhaps worsen.

Ecology of a Lake

Fishes in Lake Ontario are very important in the transport and conversion of energy in all regions of the lake. The initial input of energy is sunlight which is converted to plant tissue by photosynthesis (by producer organisms), to animal tissue (by consumers), and perhaps then to another type of animal tissue (by a carnivore). At any stage in this energy flow the organism can die and its tissues converted back to some of the original materials (nutrients) by bacteria and other decomposers (Figure 1). Conversion of light to plant tissue is restricted to the upper region of the lake (euphotic zone). These plants, primarily algal diatoms in the open water region of Lake Ontario, eventually sink below the euphotic zone and die or are carried out of the euphotic zone by consumers (fish and zooplankton). Some animals living in the depths are dependent on this transported energy source. If these highly adapted species (fish) are removed from the system the energy cycle is slowed because much of the production is "lost" to the depths rather than being reconverted and transported to another region. This means over a fixed period of time the lake is less productive because the system which took eons of time to reach the highly adapted and efficient form of converting and transporting energy has been disturbed and perhaps permanently altered.

Many of the deepwater fish of Lake Ontario have been eliminated through the disturbances caused by man. Species such as the burbot, lake trout, Atlantic salmon, deepwater sculpin, and some of the deep water coregonid chubs are extinct or greatly reduced, and their niche in the deepwater portion of the aquatic environment, to a large extent, remains vacant. Other invader fish species have gained prominence in the Lake Ontario ecosystem. Some species such as lamprey alewife and smelt have had competitive and predatory relationships with many of the native fish that were important to man, such as the lake trout, lake herring, and whitefish. Christie (1972 ms) reports that in slightly more than 100 years the open water population of the lake trout, whitefish, and ciscoes have all disappeared, leaving the lake mainly populated with American smelt and alewifes. The means by which the system can be restored to a portion of its original productivity of useful fish is dependent on an understanding of the biology and interactions of the fishes present and well coordinated programs of pest control, stocking, and selective harvest.

History of Fishery

The commercial fishery of Lake Ontario has followed the sequence of events somewhat similar to those which occurred during the collapse of the Lake Erie fishery, and the upper lakes have experienced similar problems in the last 40 years. Christie (1971 ms) describes the changes in composition of the catch - a gradual loss of the highly valued species of Atlantic salmon, lake trout, ciscos, and whitefish, and replacement with alewife, smelt, and white perch. Man's earliest impact on the fishery were stream alterations in the 1800's. Construction of mills and dams eliminated spawning areas of the Atlantic salmon. Intensive fishing with trap-nets and gill nets took a heavy toll on whitefish, cisco, sturgeon, and lake trout. A maximum annual catch of 7.5 million pounds in 1890 was followed by a precipitous decline in the late 1890's. The lake trout and whitefish stocks came back to partial strength in the 1920's, but lake herring (cisco) stocks did not recover. Ciscos remained in the harvest, but a different species, the bloater, had replaced some of the earlier deep water forms. During the 1940's and early 1950's, the lake trout population dropped and fishing pressure concentrated on the whitefish, which soon became decimated and thusly ended the open water fishery of Lake Ontario.

These population crashes were caused by a number of different factors, the complex of factors being different for each species. Christie (1971 ms and 1972 ms) speculates on the effect of competition and predation by marine invader fishes, over-fishing, loss of spawning grounds and preferred food, and interrelated combinations of these factors on the important fish species. The sea lamprey, an ancient jawless eel-like fish, and the alewife, a 6-8 inch herring, entered Lake Ontario before

1900 (Table 1). The literature of the years past has caused debate over the lamprey's colonization. If the lamprey was not a native of the fish fauna of Lake Ontario, which seems unlikely, then the colonization occurred before 1835 (Lark 1972 ms). The first catastrophic fishery collapse caused by lamprey predation (in combination with over-fishing) was in the 1940's. The alewife became established in Lake Ontario (in the 1870's) after the completion of the New York Barge Canal (1829). This forage species was kept from entering the lake through the St. Lawrence River because of the piscivorous lake trout and Atlantic salmon (Smith 1971 ms). This time lag between possible introduction and noted establishment is characteristic of invader fishes in man-made canals (Aaron and Smith 1971). A third invader species having great impact on the fishery was the American smelt which was probably placed in the Lake Erie and became well established in Lake Ontario by 1931 (Christie 1971 ms). There is an opposing theory that smelt were glacial relics being sustained in low numbers and not reported for many centuries. Other introduced species are rainbow trout, carp, and white perch (Table 2).

Early 1900's

The species most important to the fishery prior to 1940 were lake trout, cisco (4 species of "chubs" and the lake herring) and whitefish. Other species important for shorter time periods and in certain areas were lake sturgeon and Atlantic salmon, both of these fisheries were extinct by the 1900's. The adult lake trout was tolerant of lamprey parasitism and intense fishing, but the combined stresses of these factors often resulted in destruction of lake trout in the 1940's because intense fishing reduced the average size of the slow-maturing trout to a size intolerant of lamprey attack at a time when lampreys were abundant (Christie 1972 ms). Christie also attributes the extreme effect of lampreys on the fishery to the long life cycle of lamprey which results in delayed responses to environmental change, such as extreme reduction of the prey population (lake trout). Ciscos were not as tolerant of intense exploitation. Continued harvest of these coregonids after the 1920's was possible because of a shift in species abundance. The bloater (a coregonid chub) made up a large portion of the catch of the 1930's. The whitefish, a planktivorous open-water coregonid, was turned to last by the fishery. As the intensity of effort increased (partially due to improvement in gear, the nylon gill net), and the alewifes increased as the whitefish stocks declined. The last stocks of whitefish subsisting in shoal areas were being carefully studied in the Bay of Quinte, but 1971 was the last year enough fish were available to provide data for statistical analysis (Christie pers comm). The whitefish is the only species for which vital statistics have been studied in detail, and recent findings (Christie and Regier 1970) describe some regulators of population dynamics.

1940-1960

Since the loss of the most valuable fish stocks in the 1940's occurred, the open water fishes have been dominated by the planktiverous alewife. The lamprey and over-fishing had suppressed or destroyed the populations of larger fishes. Other fishes making short-term major contributions to the U. S. catch were carp in 1935-1939 and blue pike from the western region in 1952. Bullhead, perch, sunfish and eel comprised a minor fishery in shallow bay areas. Catches in Canadian waters were similar but with additional stocks of walleyes, channel catfish and northern pike. The burbot had been considered a nuisance fish through the decades of fishing because of its low commercial value and his susceptibility to gill netting. The burbot, like the lake trout, was important in terms of transporting energy from the deep regions of Lake Ontario, but the interactions of the burbot with most other fish was and still is not clearly understood (Christie 1971 ms). The burbot also served as prey for the lamprey and may have been exceptionally vulnerable because of its soft skin (Christie 1971 ms).

1965-Present

The present commercial fishery of Lake Ontario is generally dying because of the low quality and small size of the harvest. Successful warmwater commercial fisheries operating in Chaumont Bay and Bay of Quinte (Figure 2) make up a very large portion of the annual catch for Lake Ontario (Figure 3 and Table 3). The 1971 catch value for New York and Ontario totaled $516,000 (Table 3). The Ontario commercial fishery of 1969 employed 277 men. Assuming the same number of men were employed in harvesting the $437,000 catch in 1971, productivity per man was $1578. The value of the Ontario equipment in 1969 was $628,934 (Table 4). For comparison with the value of other fisheries in Canada, the 1960 Great Lakes fishery catch in Ontario was valued at $2089/man, all Ontario inland fisheries were valued at $1462/man, and both Canadian coastal fisheries were valued at $1328/man (Frick 1965). For further comparison, the average production value on Ontario workers in agriculture in 1960 was $3017/man, and $8000/man in forestry and mining.

The only significant commercial fisheries remaining in Lake Ontario are in the shoal areas in the eastern corner, but small operators will continue to hang on in other regions until nothing remains but financial ruin. The present catch statistics show the cold-water coregonids and lake trout are continuing to be irresponsibly reduced, but relatively stable warmwater fish catches in the eastern bays provide an important local industry.

The most important (potentially) component of the warmwater commercial fishery of Lake Ontario is a recent oceanic invader, the

white perch. The annual catch of white perch (actually a temperate bass) has nearly caught up with the annual catch of yellow perch, which accounted for 23% of the total 1971 catch (Table 3). The greatest increases in white perch are found in shallow waters rather than in the open lake (Figure 4). The white perch probably entered Lake Ontario through the New York Barge Canal and the Oswego River about 1950 (Christie 1972 ms). By springtime 1960, they were more abundant in samples in the Bay of Quinte than any other fish but the alewife. Many areas in the Bay of Quinte previously occupied by smelt, pike, largemouth bass and bowfin are now dominated by white perch. The relationship between these fish and the invader is unclear (Christie 1972 ms).

Other species important in the 1971 catch are yellow perch, the most abundant and comprising about 30% of the total catch value (Table 3) and bullhead, carp, and smelt. Yellow perch stocks have expanded greatly in the open waters of Lake Ontario (Figure 5). The value of the catch is greatest for yellow perch, white perch, bullheads and eels, respectively. There are some interesting differences in price values of white perch between the United States and Canada. White perch in the U.S. catch are worth three times as much as those in the Ontario catch (Table 5); even though 85-90% of the Ontario catch is exported to the United States (Adams pers. comm).

New York catches from Chaumont Bay (primarily bullheads) are sold locally and shipped to Fulton Market in New York City (Stone pers. comm). The largest operation in U.S. waters, Cahill in Oswego, New York, ships its catch to Buffalo, Rochester, and New York City. Some species such as white perch, are filleted, deep-fat fried and sold locally in Oswego (Stone pers. comm). Most Ontario commercial fishermen sell their warmwater fish catch to four fish canneries in the Bay of Quinte area. Smart Fish Company of Kingston, Ontario is one of the larger operations in Canadian waters (Adams, pers. comm). Olmstead of Wheatley, Ohio has a modern fleet of fishing boats and his catch accounts for a good portion of the annual harvest. Eels are caught in eel pots and traps in the bays in the northeast shallow portion of Lake Ontario and near tributaries in other parts of the lake. Most eels are marketed in Montreal, but mercury levels in the eels has become a matter of concern and has depressed the eel market. Smelt and alewifes are processed and sold for pet food locally by Mummery of Toronto. Smelt processing has been mechanized and becomes worth the expense of sorting the seine hauls when the market gets above $0.10 per pound (assuming no transporting or freezing loss) (Frick 1965). Frick (1965) describes the past processing and marketing of lake trout, whitefish, herring, and the present day operations with yellow perch. An extensive report entitled "Marketing Fish in Canada" and a fish marketing survey in Toronto by the Ontario Department of Lakes and Forests are available in a unpublished form from the manager of the Fisheries Council of Canada in Ottawa. The Freshwater Fish

Marketing Corp., which began operating in 1969, helps to stabilize prices and improve bargaining for commercial fishermen in the upper Great Lakes and Western Canada (Brubacher 1969).

Licensing and Gear Regulations

Licensing of commercial fisherman is handled by the individual governments, but a binational organization, the Great Lakes Fishery Commission, is to receive reports and mediate catch regulations. Ontario commercial licenses are sold openly at times, and are passed on as family rite. In the last 20 years, the number of Ontario fishermen on Lake Ontario has dropped from 635 (1950) to 277 (1970) (Tables 4 and 6). Gill nets and hoop nets are the most common gear throughout most regions, and the Bay of Quinte fishery also relies heavily on hook lines and seining (Table 7). The 1969 fishery of Chaumont Bay was most dependent on trap nets. New York commercial licenses are sold openly on a yearly basis. In the last 20 years, the number of licenses has dropped from 45 (1950) to 18 (1970) (Table 8).

The use and misuse of this enormous fishery resource has been "regulated" by governments and biologists who had inadequate information and funds for managing the fishery. Markets, technology, and the persistence of the fishing industry have been the major forces in directing the selective fishing pressure and over-exploitation. Binational cooperation is essential for meaningful record-keeping and decision-making for the fishery.

There are few working models of international management of similar large fisheries. The coregonid-salmonid fishery of Lake Constance between Austria, West Germany, and Switzerland has experienced many of the problems facing Lake Ontario; and a sound, but not completely effective, international organization has been operating since 1894 (Nümann 1971 ms).

Great Lakes Fishery Commission

The first effective move toward controlling fishing in Lake Ontario through international agreements was initiated by New York and Ontario in the late 1940's. The Lake Ontario Management Commission was an informal group cooperating until 1955 when the Great Lakes Fishery Commission was officially established. A treaty of 1946 set the specifications for the organization, but legislators resisted granting regulatory powers to the commission until 1955 (Piper 1967). The Commission consists of three representatives from each country and has been delegated powers to set regulations on season, gear, catch quotas, and to conduct research, carry out any needed stocking programs,

compile data, and to develop a comprehensive plan for effective management of the fishery resource of the Great Lakes with a goal of maximum sustained yield. The organizational relationships are described in Appendix D.

The task of "managing" the fisheries of Lake Ontario at such a late stage of deterioration was quite formidable. The fishery catch had never been "managed" nor had basic fish population research approached the sophistication of understanding the size harvest needed to sustain a fishery yield which was maximum in size. The optimum yield is, of course, different for each species.

With the lake trout in near-extinction, the first task was to rid the waters of the destructive sea lamprey. The lamprey control program has been the principal accomplishment of the G.L.F.C. Until recently, most research was uncoordinated and often concentrated on isolated segments of the aquatic problem. The G.L.F.C. has been criticized because it hasn't developed a comprehensive management plan for the Great Lakes fisheries even though significant progress has been made in controlling the lamprey. Control efforts were first directed toward the upper Great Lakes because of the more recent (1950's) collapse (Figure 7). The fishery of Lake Ontario had been upset for nearly a generation and control efforts and funds were postponed more than 10 years. Lamprey control crews treated 22 lamprey spawning streams in October 1971 in Ontario and in May 1972 crews treated 19 streams and 38 tributaries in New York (Neth 1972). Low-head dams which allow valuable fish to pass over, but prevent free swimming lampreys from entering the spawning grounds are planned as permanent control measures for many of the important lamprey tributaries. Control measures will only depress the lamprey numbers and probably never eliminate them. The intensity of this control effort will therefore be dependent on the economic decision concerning the cost of additional units of treatment and the resultant increase in man's share of the fishery.

Stocking programs are discussed at G.L.F.C. meetings, but there has been no big breakthroughs toward cooperation in a planned program aiming for a restructured ecosystem. There are still too many unknowns about the lake, unknowns about the success of the fishes introduced, and there are too many vested interests preventing biologists from making one strong thrust with a few selected species. A more promising program under the joint direction of the G.L.F.C. is the International Field Year Great Lakes (IFYGL). The 1971 and 1972 programs are directed toward developing background information on the physical and biological limnology of Lake Ontario. Extensive reports are now becoming available.

Stocking

Stocking programs were attempted in Lake Ontario as early as 1878 with the rainbow trout. Efforts with other salmonids are now being attempted on a larger scale. Recent introductions have shown little coordination among managing agencies (Christie 1968). There are many complicating factors in these stocking programs because the philosophy or basic design of the future fishery is not well-defined. Problems arise from (1) public pressure for exotic fish which have done well elsewhere, (2) shortage of funds, (3) inadequate information on species requirements, and (4) inadequate information on the lake's changing status. Without this information, much of which may be available in a few years, the stocking program is still forging ahead in the traditional "trial and error" fashion. Christie (1968) (1970) and Regier (1968) discuss some of the potential exotic fish species and the problems in stocking programs.

It seems most decision-makers agree that the Lake Ontario fishery should be restructured (through stocking and control) for the most efficient, useful fishery production. The lake trout has proven to be the major vector in transporting materials and energy through the lake (Christie 1972 ms). Once lamprey populations are reduced, a stocking of fish with characteristics similar to the lake trout would seem to be a logical choice. The fisherman are accustomed to harvesting lake trout, and lake trout live compatibly with most other fishes already present. Problems with lake trout are (1) slow maturity (increasing the vulnerability to lamprey predation) and (2) susceptibility of the eggs to predation by the slimy sculpin. The splake, a cross between brook trout (1/5) and lake trout (4/5) has been developed by Ontario. The fish is faster maturing than the lake trout and more active while occupying the depths. Even though some aquarium studies indicate lamprey preference for splake, this greater activity may decrease their susceptibility to lampreys in open waters. Another possibility is the "Finger Lakes strain" lake trout which is reported less vulnerable to lamprey attack. Pearce (pers. comm) reports gill net returns of "Finger Lake strain" lake trout stocked in Lake Ontario in the early 1960's indicate they can tolerate the conditions and should be the focus of a stocking program. Christie (pers. comm) and many other biologists are in favor of focusing on splake. If splake are to maintain the characteristics of the hybrid in a natural population, then lake trout must not be available for crossbreeding.

The 1972 stocking programs are heavily weighted toward coho (silver) salmon, chinook (king) salmon, and kokanee (landlocked sockeye) salmon. New York is severely limited by funds, but the stocking program has expanded from the single species effort (coho) of 1968-1971 to coho and chinook in 1972. Future plans include steel-head (rainbow) trout, landlocked Atlantic salmon, and splake (Table 9).

The projected stocking program described by the director of the laboratory responsible for formulating the management plan for Lake Ontario, Pearce at Cape Vincent, New York, does not rely on natural reproduction of the stocked fish, but rather relies on annual plantings. Ontario's stocking programs are concentrating on coho, chinook, kokanee, rainbow and splake (Table 10). More optimism was expressed for reproduction of the introduced fishes by Ontario biologists (Christie pers. comm.).

The coho salmon may be filling a niche left by the Atlantic salmon (Christie pers. comm.). G.L.F.C. (1970) reports that coho stocked in 1969 are showing extreme susceptibility to lamprey predation after reaching 16-17 inches. The kokanee is a planktivore which comes inshore to brooks for spawning. The rainbow trout became important in the sport fishery in the 1950's, but the original stock is uncertain (Christie 1971 ms). The rainbow has many habits similar to the Atlantic salmon but can tolerate warmer waters in the upstream migration, and spawns in the spring rather than fall. Steelhead trout are a race of rainbow trout originating in the western United States. Atlantic salmon has received growing attention for stocking as hatchery rearing success has increased. Presently there are few hatcheries equipped to handle Atlantic salmon, but plans for hatchery expansion are on the drawing board, and further expansion may be implemented for ocean-going strains to be cultured for other rivers in the eastern United States.

The development of a salmonid fishery may primarily serve anglers rather than commercial fishermen, as the demand for sport fishing is rapidly outgrowing the supply of accessible good fishing areas. Even though improved public information and education, more access to public waters, and more intensive management could solve a good portion of this inland resource shortage, the enormous potential of Lake Ontario and adjoining streams could evolve into a multi-million dollar fishery. The combination of commercial and sport fishing can be managed to successfully maximize the harvest, but severe conflicts can result if public education and sensible regulations are not promoted. Presently the only interaction between commercial fishermen and anglers is in the Bay of Quinte-Chaumont Bay-Thousand Islands region of Lake Ontario. Conflicts have developed between smallmouth bass anglers and yellow perch and white perch gill net operations. Christie (1965) ranks walleye as the most disputed over fish in all the Great Lakes, but the walleye stocks in Lake Ontario are becoming exceedingly low. He also feels commercial fishermen must be versatile, mobile, and given freedom of movement and gear if they are to survive. It is advantageous to couple sport and commercial fishing because commercial operations are attracted to maximum biomass rather than size and they can work types of areas not accessible to anglers.

Sport Fishing in Lake Ontario

The sport fishery of Lake Ontario is presently of minor importance in most regions except for the northeast corner of the lake. Stream-run salmonids (mostly rainbow trout) are important in many tributaries, but few fish are caught in the immediate waters of the lake. The smelt fishermen number more than one thousand in Ontario and probably more in New York. The warmwater fishery in the shoal area from Brighton to Stony Point (Figure 2) is dominated by yellow perch, rock bass, northern pike, and smallmouth bass. Smallmouth bass and pike (and walleye until recent years) are most important in Canadian waters; and smallmouth bass is most important in U.S. waters. The fishery extending up the St. Lawrence River has smallmouth bass as by far the most important species. A 1971 census for northeastern regions of Ontario waters shows about equal importance (number of rod hours spent) for pike and smallmouth bass with increasing catches of yellow perch (Appendix B). Jolliff and LeTendre (1966) report the sport fishery of the U. S. eastern Lake Ontario-St. Lawrence River area was most dependent on smallmouth bass. Fishermen preferred smallmouth bass, northern pike, and yellow perch, respectively; but the catch was greatest in yellow perch and rock bass, respectively. Three out of four fishermen in the Thousand Islands region were New York State residents. Earlier reports on the fishery are Pearch (1961) in winter; and Stone, Pasko and Roecker (1951) in summer. A comprehensive plan for increasing the warmwater fishery and developing a salmonid fishery for this region is described by Pearce in the Great Lakes Basin Framework Study (GLBFS) Appendix 8 draft 2 (1972).

The plans for developing a salmonid fishery in Lake Ontario are directed toward the sport harvest. To date, the experimental stocking has not developed a viable fishery. With lamprey control programs underway, and extensive stocking programs being initiated, the future sport fishery of Lake Ontario could become very prosperous and develop into an important recreation resource.

Sport Fishery around Lake Ontario

Angling in the Lake Ontario drainage basin provides some of the finest freshwater fishing in the Northeast. The lakes region of northern Ontario (outside the Basin) offers an additional fishery to the rugged sportsman and is within a days travel time for most people in the Basin. Warmwater as well as cold water fishing are found throughout the basin; with the better areas being located in the Finger Lakes, Adirondacks, Trent-Severn, and Thousand Islands regions. Statistics on fishing licenses issued within the Basin are not available, but the 1969 total for the province (51% of the 1969 Ontario population lived in the Basin) was 610,668 resident licenses, and 813,718 1970 resident licenses in New York (11% of the 1960 New York population lived in the Basin).

The sport fishery in the U.S. portion of the basin is thoroughly assessed with projected demands and proposals for meeting future requirements in the GLBFS Appendix 8, draft 1 (Appendix E). Subregion 5.3 in the northeast portion of the southern basin (Figure 8) contains the greatest number of cold and warmwater streams and has the greatest acreage of ponds. Brook, brown, and rainbow trout are extremely valuable fish in this subregion. Many streams have strong potential for salmonid spawning runs if the Lake Ontario anadromous fish program is successful. Subregion 5.2 through the central basin contains the deep Finger Lakes and many smaller shallow lakes. Rainbow and lake trout provide an extensive fishery in the Finger Lakes and warmwater fisheries include yellow perch smallmouth bass, walleye, and northern pike. Subregion 5.1 contains the least number of ponds, but offers a wide variety of warm and cold water fish habitats. The warmwater fishery is most important, with yellow perch, northern pike, walleye, and smallmouth bass supplying the mainstay of the catch.

Sport fishing in Ontario is administered by the Department of Lands and Forests, which carries out extensive stocking programs for warm and cold-water fishing. Ten pond-fishing areas near urban centers are operated by the provincial government on an intensive basis to provide the public with trout fishing. Eight other provincial parks offer lake and stream fishing. Many conservation authority parks provide pond and brook fishing, and the Federal park is in the heart of the Thousand Island fishing area. A 1971 creel census at lakes in the Prince Edwards County area show walleye, northern pike, and smallmouth bass to be most important (Appendix B). The outdoor recreation section of this report describes boating and fishing services provided by public and private agencies.

Future of the Fishery

The Great Lakes Fishery Commission first officially met in 1956 with the assigned task of developing and coordinating a comprehensive fisheries management program for the lakes. Among the many problems confronting the group were (1) a collapsed fishery; (2) differences of interest between the many governments; (3) many uncoordinated agencies funding and regulating parts of the fishery; and (4) lack of knowledge about the biology of the lake ecosystems. Many advances have been made; but the lakes, particularly Lake Ontario, have not been managed in conjunction with a mutually agreed upon comprehensive plan for maximizing a harvest. In some respects, the G.L.F.C. has failed to address itself to the basic purposes of management - serving the desires of the users and refining the tools (or understanding the forces) available to manipulate the resource. In recent times, research has been directed toward actual management tools, but the many years

of uncoordinated research on segments of the ecosystem have offered little if anything to the management needs. Recent studies on environmental and man-made forces regulating the strengths of animal populations are building the information base needed to manage a fishery. There is a dire need for more comprehensive studies using a team approach to uncover the workings of the ecosystem.

Problems which are not receiving enough attention from the G.L.F.C. include a lack of agreement between decision-makers on specific management goals such as the philosophy of stocking, public information, and coordination with other joint operations, e.g., the International Joint Commission (IJC). The public must be better informed on the enormous potential of the Great Lakes as a recreation and life support resource. There must be stronger support for the G.L.F.C. if it is to gain more authority. Much of the funding is still handled at a regional rather than at the international level. Financial incentives properly applied through the G.L.F.C. are needed to counterbalance the parochial attitudes found in the regional agencies and publics. The commercial fishermen now operating in Lake Ontario should be studied as a group and they should be encouraged to adopt more cooperative working relationships. A strong working relationship should be developed between the G.L.F.C. and the commercial fisherman now when resource users are few. The fisherman community will probably resist organization, but some sort of communication channels must be established if the common goals of a free operating market, effective technical assistance, and ease in information exchange are to be attained.

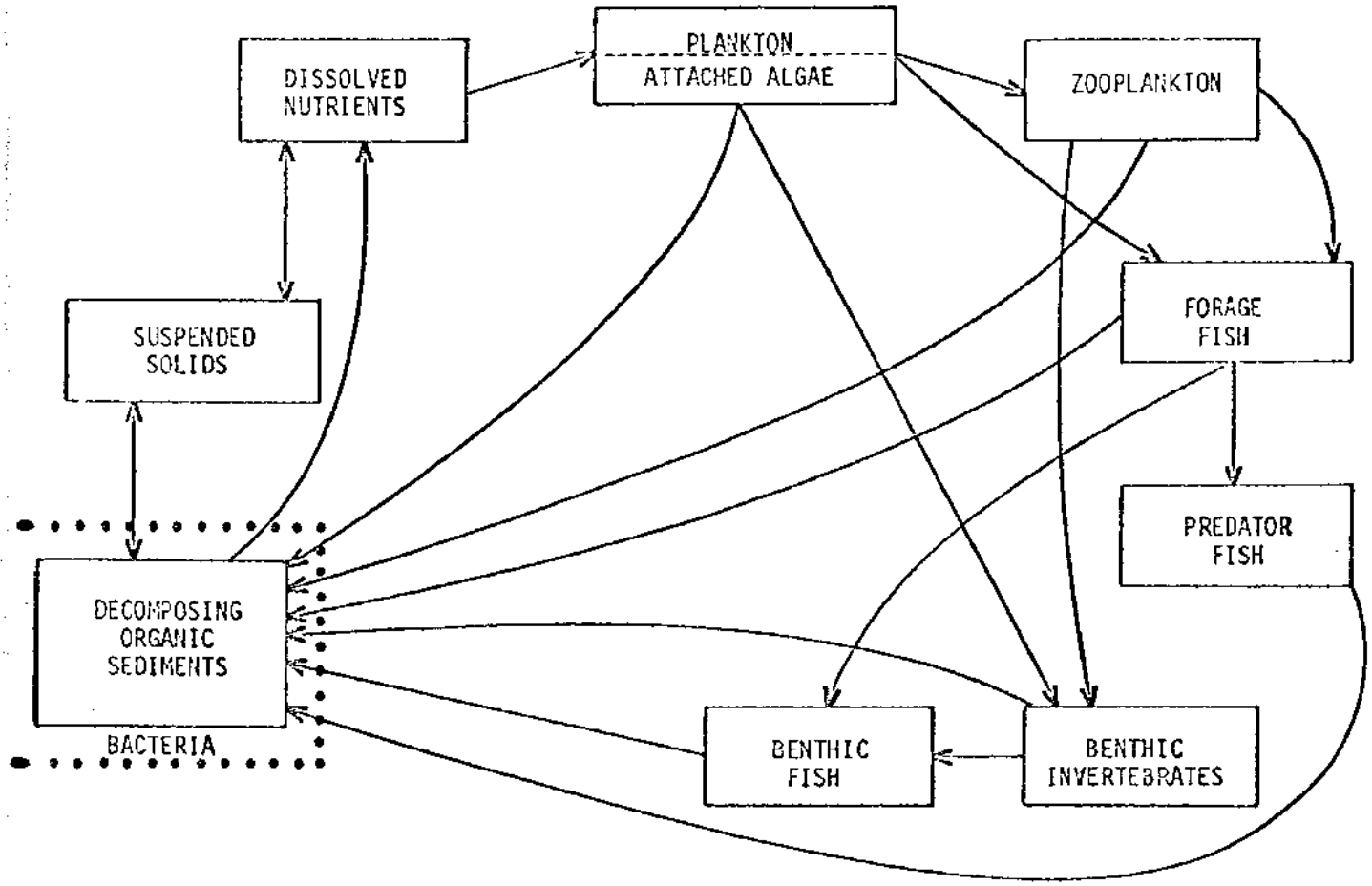
The inland sport fishery is closely tied to the lake fishery and if the salmonid program is successful, it will become increasingly important that close cooperation is maintained among governments. Presently, there is limited information exchange among agencies dealing with sport fishing outside the immediate waters of Lake Ontario. When the salmonid program begins to gain momentum, more coordination will be necessary. Presently, closer communication between these agencies would be instrumental in reducing the stifling provincial approach to management and would help these decision-makers better understand the differences in interest and operations which do exist between regions.

Summary

Lake Ontario's future as a useful fishery is in the hands of the G.L.F.C. This organization has had many problems in attempting to manage the fishery resource. Despite the lack of coordination among other agencies influencing water quality and other international functions, the G.L.F.C. has made progress in certain areas of the fishery problem, such as lamprey control, central data collecting and filling

in some of the gaps in general biological information. A more complete summary of the biota and the commercial fishery is found in Appendix F. The most obvious inadequacy is the lack of support and authority. This is partially due to a weak publicity program and a lack of responsiveness by planners to the desires of the general public. These communicatio problems have resulted in (1) a stocking program being "uncontrollably" split in many directions; (2) conflicts between decision-makers ; and (3) prolonged depression of a potentially enormous fishery resource. Closer binational cooperation could lead to more useful research and mutual respect among biologists, policymakers, and all resource users.

Figure 1. Energy Flow within Lake Ontario's Ecosystem



ENERGY FLOW WITHIN
LAKE ONTARIO'S ECOSYSTEM

Prepared by
W. L. Hartman
U.S.B.S.F.& W.

From Hartman and Reynolds (1971)

Table 1. First Observation of Three Exotic Fishes in the Great Lakes

Lake	Year of first record		
	Sea lamprey	Alewife	Smelt
Ontario	?*	1873	1931
Erie	1921	1931	1935
Huron	1932	1933	1925
Michigan	1936	1949	1923
Superior	1946	1953	1930

*First problems caused by sea lampreys noted in the 1880's

From Smith (1971 ms)

Table 2

Long-Term Changes in Fish Fauna* of Lake Ontario

A. Species Extinct or Greatly Reduced

i Before 1900

Common Name	Scientific Name
Lake Sturgeon	Acipenser fulvescens (Rafinesque)
Atlantic Salmon	Salmo salar (Linnaeus)
Blackfin Cisco	Coregonus nigripinnis (Gill)

ii After 1900

Lake Trout	Salvelinus namaycush (Walbaum)
Shortnose Cisco	Coregonus reighardi (Koelz)
Bloater	Coregonus hoyi (Gill)
Kiyi	Coregonus kiyi (Koelz)
Burbot	Lota lota (Linnaeus)
Blue Pike	Stizostedion vitreum glaucum (Hubbs)
Fourhorned Sculpin	Myoxocephalus quadricornis (Linnaeus)

B. Species Colonized

i Before 1900

Alewife	Alosa pseudoharengus (Wilson)
Gizzard Shad	Dorosoma cepedianum (Lesueur)
Brown Trout	Salmo trutta (Linnaeus)
Carp	Cyprinus carpio (Linnaeus)
Goldfish	Carassius auratus (Linnaeus)

ii After 1900

Rainbow Trout	Salmo gairdneri (Richardson)
Rainbow Smelt	Osmerus mordax (Mitchill)
White Perch	Morone americana (Gmelin)

* Includes lake fish and fish in tributaries near or at lake level.

C. Species Persisting

Common Name	Scientific Name
Sea Lamprey	Petromyzon marinus (Linnaeus)
Longnose Gar	Lepisosteus osseus (Linnaeus)
Bowfin	Amia calva (Linnaeus)
Mooneye	Hiodon tergisus (Lesueur)
Brook Trout	Salvelinus fontinalis (Mitchill)
Cisco (Lake Herring)	Coregonus artedii (Lesueur)
Lake Whitefish	Coregonus clupeaformis (Mitchill)
Round Whitefish	Prosopium cylindraceum (Pallas)
Common White Sucker	Catostomus commersonii (Lacepede)
Greater Redhorse	Moxostoma valenciennesi (Jordan)
Lake Chub	Couesius plumbeus (Agassiz)
Longnose Dace	Rhinichthys cataractae (Valenciennes)
Golden Shiner	Notemigonus crysoleucas (Mitchill)
Common Shiner	Notropis cornutus (Mitchill)
Spottail Shiner	Notropis hudsonius (Clinton)
Spotfin Shiner	Notropis spilopterus (Cope)
Brown Bullhead	Ictalurus nebulosus (Lesueur)
Stonecat	Noturus flavus (Rafinesque)
Central Mudminnow	Umbra limi (Kirtland)
Grass Pickerel	Esox americanus vermiculatus (Lesueur)
Northern Pike	Esox lucius (Linnaeus)
Muskellunge	Esox masquinongy (Mitchill)
American Eel	Anguilla rostrata (Lesueur)
Banded Killifish	Fundulus diaphanus (Lesueur)
Troutperch	Percopsis omiscomaycus (Walbaum)
White Bass	Morone chrysops (Rafinesque)
Yellow Perch	Perca flavescens (Mitchill)
Walleye	Stizostedion vitreum vitreum (Mitchill)
Logperch	Persina caprodes (Rafinesque)
Johnny Darter	Etheostoma nigrum (Rafinesque)
Smallmouth Bass	Micropterus dolomieui (Lacepede)
Largemouth Bass	Micropterus salmoides (Lacepede)
Pumpkinseed	Lepomis gibbosus (Linnaeus)

C. Species Persisting Cont'd.

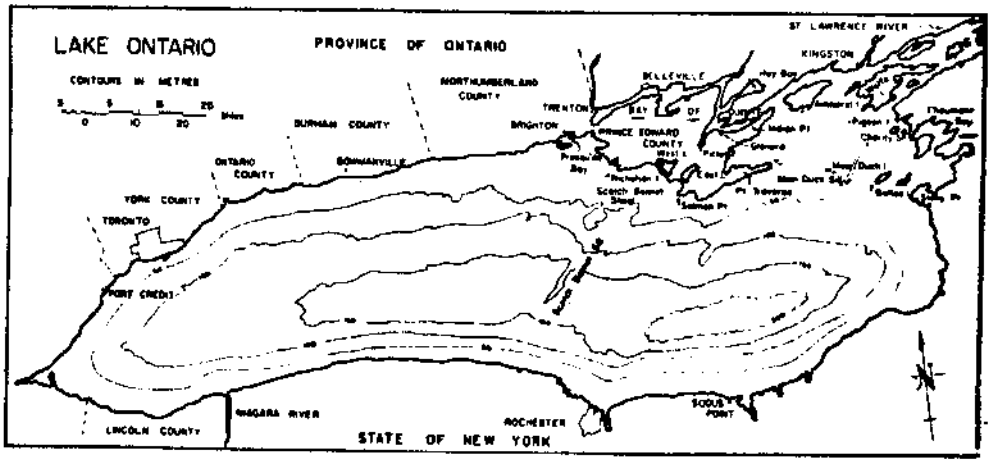
Common Name	Scientific Name
Bluegill	Lepomis macrochirus (Rafinesque)
Brook Silverside	Labidesthes sicculus (Cope)
Freshwater Drum	Aplodinotus grunniens (Rafinesque)
Mottled Sculpin	Cottus bairdii (Girard)
Slimy Sculpin	Cottus cognatus (Richardson)
Threespine Stickleback	Gasterosteus aculeatus (Linnaeus)
Brook Stickleback	Culaea inconstans (Kirtland)
Ninespine Stickleback	Pungitius pungitius (Linnaeus)

D. Species Previously Reported and of Uncertain Status

Coho Salmon	Oncorhynchus kisutch (Walbaum)
Chinook Salmon	Oncorhynchus tshawytscha (Walbaum)
Sockeye Salmon (Kokanee)	Oncorhynchus nerka (Walbaum)
Northern Quillback Carpsucker	Carpiodes cyprinus (Lesueur)
Eastern Longnose Sucker	Catostomus catostomus (Forster)
Silver Redhorse	Moxostoma anisurum (Rafinesque)
Shorthead Redhorse	Moxostoma macrolepidotum (Lesueur)
Northern Hog Sucker	Hypentelium nigricans (Lesueur)
Fallfish	Semotilus corporalis (Mitchill)
Sauger	Stizostedion canadense (Smith)
White Crappie	Pomoxis annularis (Rafinesque)

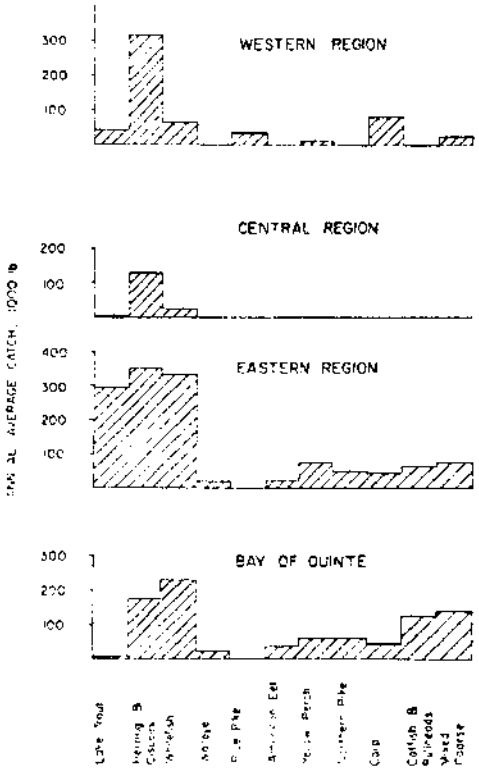
From Christie (1971 ms)

Figure 2. Map of Lake Ontario Showing Bathometric and Political Features



From Christie (1972 ms)

Figure 3. Species Distribution in Canadian Lake Ontario Fish Catch 1925-1949



From Christie (1972 ms)

Table 3

Commercial Catch in Lake Ontario - 1971

	ONTARIO		NEW YORK STATE			
	All Waters		Chaumont Bay		Open Waters	
	lb. x 10^3	Value	lb. x 10^3	Value	lb. x 10^3	Value
		in thous.		in thous.		in thous.
Yellow Perch	758	$ 153	13	$ 3	5	$ 1
White Perch	634	64			36	9
Bull Head	593	39	95	29		
Carp	429	51	22	1		
Smelt	187	30				
Eels	106	41	50	13		
Sunfish	141	16	9	2		
Rock Bass	53	9	8	0.7	3	0.2
Catfish	25	10	1	0.4		
Lake Herring	20	4				
Northern Pike	15	2				
Lake Whitefish	15	8				
Walleye	7	3				
Sucker	7	0.4	6	0.4		
White Bass	3	0.9	75	19	2	0.4
Bowfin			1	0.1		
Burbot						
Cisco						
Crappie			4	0.6		
Drum						
Others	40	6.0				
TOTALS	3,033	$437,300	284	$ 68,600	46	$ 10,600

Total Catch 1971 - 3,363,000 lb.
Value - $516,500

From GLFC(1972)

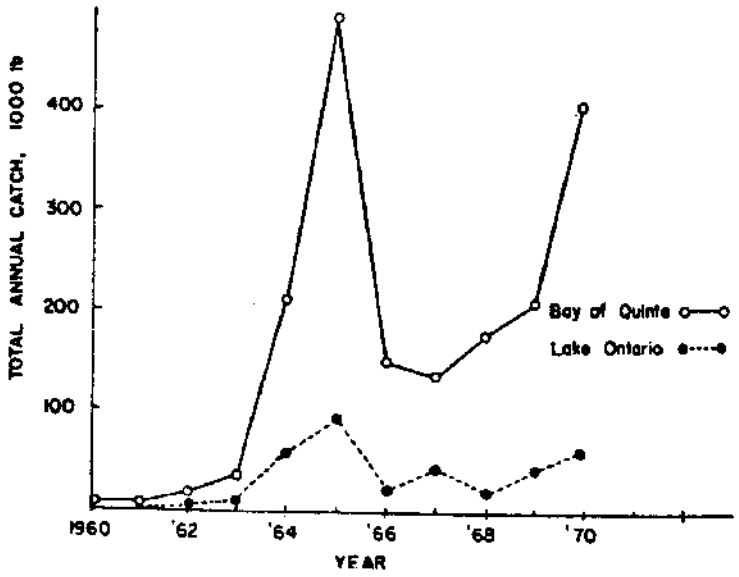
Note: Catches under 1000 lb. and their values are not included. Original figures are rounded, therefore totals may vary.

Table 4. Ontario Commercial Fishing Equipment for Lake Ontario 1969

		Lake Ontario
NUMBER OF MEN EMPLOYED:		277
FISHING BOATS:		
40' and over	No.	4
	Tons	50
	Value ($)	24,000
20' to 39'	No.	56
	Value ($)	97,275
Under 20'	No.	207
	Value ($)	66,983
FISHING GEAR:		
Gill Nets	Yards	926,428
	Value ($)	226,078
Pounds Nets	No.	1
	Value ($)	200
Trap Nets	No.	32
	Value ($)	9,550
Hoop Nets	No.	848
	Value ($)	77,275
Seine Nets	Yards	2,740
	Value ($)	5,490
Night Lines	Hooks	30,100
	Value ($)	3,770
Dip Nets	No.	2
	Value ($)	50
Trolling Lines	No.	18
	Value ($)	743
Trawls	No.	–
	Value ($)	–
SHORE INSTALLATIONS:		
Freezers and Ice Houses	No.	21
	Value ($)	15,100
Piers and Wharves	No.	39
	Value ($)	14,155
Net Sheds	No.	123
	Value ($)	88,265
TOTAL VALUE		$ 628,934

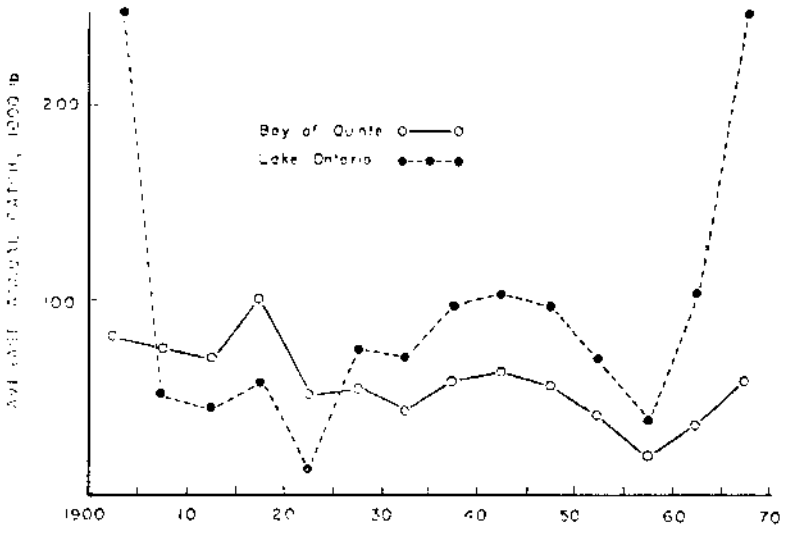
From Ontario Department of Lands and Forests (1971)

Figure 4. Trends in Canadian Commercial White Perch Catch. Lake Ontario Data are Exclusive of Bay of Quinte Values



From Christie (1972)

Figure 5. Trends in Canadian Commercial Yellow Perch Catch. Lake Ontario Data are Exclusive of Bay of Quinte Values



From Christie (1972 ms)

Table 5. Unit Value of 1971 Commercial Catch in Lake Ontario for Three Fish

	White perch price/lbs.	Yellow perch price/lbs.	Bullhead price/lbs.
New York-Chaumont Bay	.25	.16	.30
New York-Open waters	.31	.31	.33
Ontario-all of fishery	.10	.20	.07

Taken from Table 3

Table 6. Number of Fisherman and the Value of Fishing Equipment in the Ontario Fishery of Lake Ontario 1946-1961

Year	Number of fishermen	Boats		Gear		Shore equipment		Total	
		Value in dollars	Value per fisherman	Value in dollars	Value per fisherman	Value in dollars	Value per fisherman	Value in dollars	Value per fisherman
				Lake Ontario					
1946	646	152,900	237	155,756	241	15,880	24	324,536	502
1947	631	171,896	273	214,758	340	16,502	26	403,156	639
1948	701	182,576	260	219,855	314	20,880	30	423,311	604
1949	678	176,667	261	231,259	341	15,647	23	423,573	625
1950	635	180,442	284	227,908	359	19,075	30	427,425	673
1951	634	205,498	324	259,729	410	17,798	28	483,025	762
1952	648	212,464	328	303,083	468	81,840	126	597,387	922
1953	625	192,317	308	280,604	449	87,485	140	560,406	897
1954	587	166,736	284	250,969	427	74,870	128	492,575	839
1955	509	147,768	290	271,616	534	79,565	156	498,949	980
1956	497	159,160	320	288,591	581	82,519	166	530,270	1,067
1957	495	169,488	342	286,566	579	92,085	186	548,139	1,107
1958	433	165,923	383	264,507	611	81,010	187	511,440	1,181
1959	587	187,402	319	323,672	551	124,245	212	635,319	1,082
1960	494	181,340	367	309,171	626	114,615	232	605,126	1,225
1961	376	170,660	454	302,617	805	107,299	285	580,576	1,544

[a] *Annual Report of the Minister of Lands and Forests of the Province of Ontario.* Omitted are the numbers of "Freezers and icehouses", "Piers and wharves", and "Net sheds", also small numbers of dip and roll nets (Lakes Ontario, Erie, and St. Clair) and trolling lines (Lakes Ontario and Superior). Otter trawls listed for Lake Erie increased from 11 in 1959 to 60 in 1961.

[b] Fishing boat classifications before 1952 were "Tugs," "Gasoline launches," and "Sail and row boats."

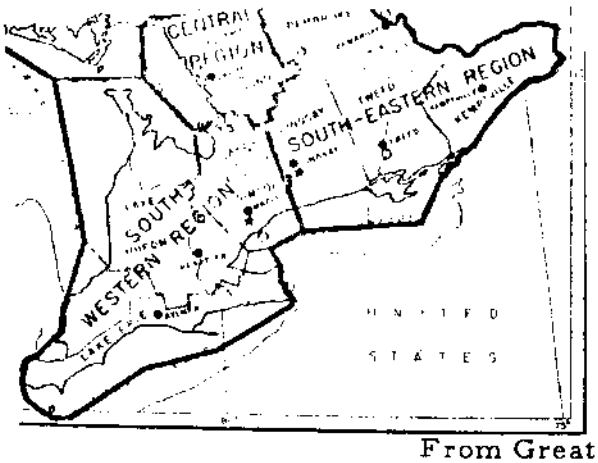
From Frick (1969)

Table 7

Fishing Gear in Active Use on the Canadian Side of Lake Ontario

1971

Gill Net	Hoop Net	Hooks	Carp Gill Net	Seine	Trap	Dip	TOTAL
KEMPTVILLE							
3	29	3				1	36
TWEED							
122	69	42		19	4	1	257
LINDSAY							
22	6	4			5		37
MAPLE							
		1				1	2
HESPELER							
2				1		1	4
LAKE ERIE DISTRICT							
6							6
155	104	50		20	9	4	342



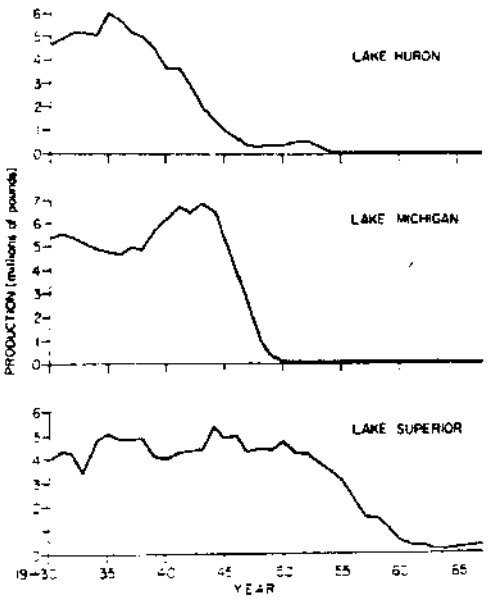
From Great Lakes Fishery Commission (1972)

Table 8 SUMMARY OF COMMERCIAL FISHING LICENSES 1950-1970

Chaumont Bay - Lake Ontario

	Chaumont Bay Area					Lake Ontario	
Year	No. of licenses	No. of traps	No. of fykes	No. of gills	No. of seines	Boats fishing gill nets	Traps & fykes
1950	45	104	77	2	2	42	4
1	46	102	77	6	1	42	4
2	52	86	98	6	1	50	2
3	50	89	93	5	1	45	6
4	49	76	91	6	3	46	8
5	45	66	58	5	2	36	13
6	40	59	82	3	2	43	3
7	?	?	?	?	?	36	3
8	43	60	66	4	2	24	4
9	47	60	55	3	5	25	4
1960	41	67	20	0	3	17	2
1	50	78	58	1	3	18	6
2	43	82	46	0	1	19	3
3	47	87	59	1	3	13	3
4	31	72	43	1	1	10	3
5	35	83	45	4	2	11	2
6	33	96	35	4	2	10	0
7	28	99	21	3	1	5	1
8	34	114	25	2	2	4	1
9	27	108	15	1	3	4	0
1970	18	95	34	2	1	4	0

Figure 7. Commercial Production of Lake Trout from the Upper Great Lakes 1930-1967



From Lawrie (1970)

Table 9. New York Salmonid Stocking Program for Lake Ontario

Smolt size fish

	1968	1969	1970	1971	1972	Projected Peak Stocking -annual-
Coho	25,000	124,000	223,000	122,000	250,000	1,000,000
Chinook					500,000	500,000
Steelhead						400,000
Atlantic Salmon						100,000
Splake						500,000

From Neth (1972)

Table 10

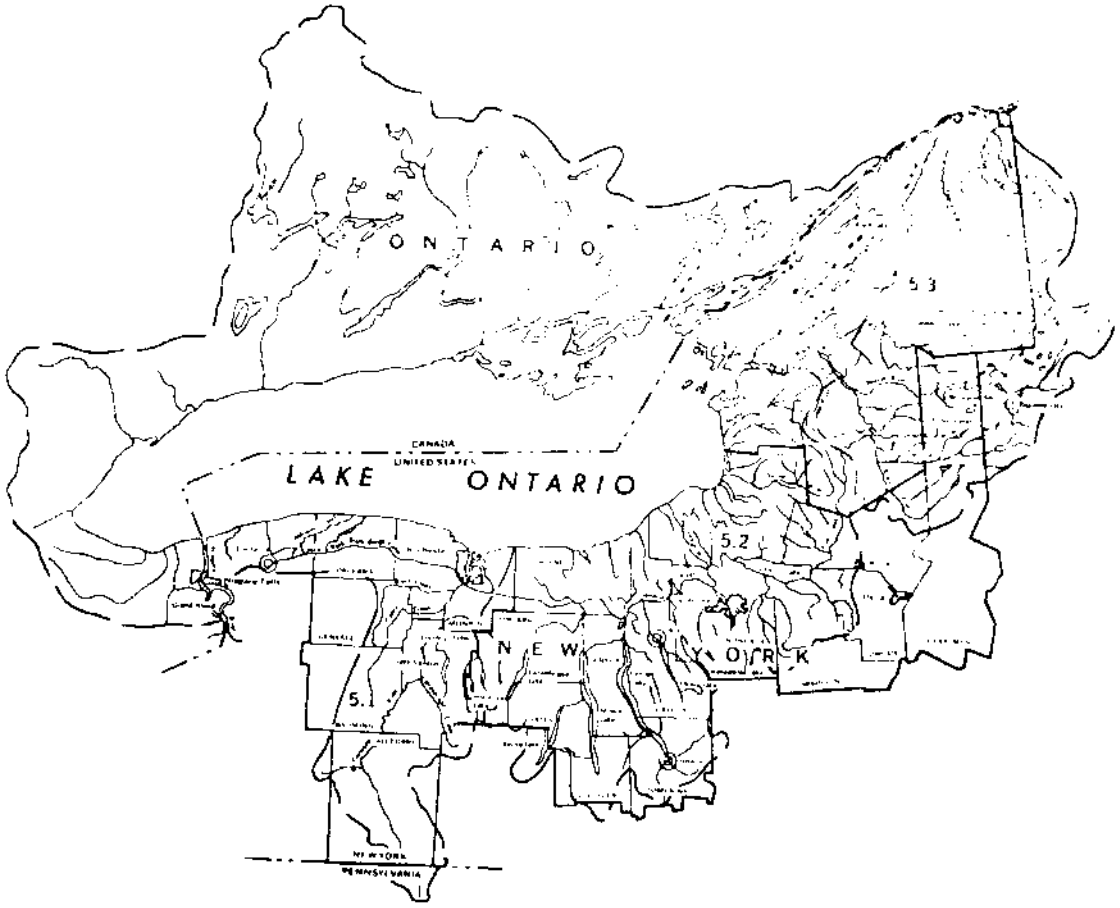
1971 AND PROPOSED 1972 PLANTING SCHEDULE BY THE PROVINCE OF ONTARIO - LAKE ONTARIO
(Yearlings unless otherwise noted)

	1971		1972
	Proposed	Stocked	Current Objective
Coho	150,000	162,000	125,000
Chinook	80,000 fg	90,000 fg	150,000 fg
Kokanee	-	680,000 fr; 50,000 fg.	50,000 fg
Rainbow	30,000	19,000	75,000
Splake	-	-	50,000

fr = fry
fg = fingerlings

From Great Lakes Fishery Commission (1972)

Figure 8. Subregions of the Southern Portion of the Great Lakes Basin Assessed by Great Lakes Basin Framework Study 8



PLAN AREA NO. 5

SCALE IN MILES
0 10 20 40

From Great Lakes Basin Framework Study No. 8

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PART TWO

Outdoor Recreation

Outdoor recreation, or outdoor experiences are becoming increasingly important as our society continues to grow and urbanize. With increased leisure time, travel opportunities, and interest in casual to vigorous outdoor activities, the demands on our recreation resources have multiplied. Recreational travel became important after the 1930's when road building programs opened many recreational areas for public access. With increasing family mobility over the past decades, pressures of overuse have made long range planning essential for preserving, managing and developing natural areas. Dworsky, et al., in an unpublished study in 1971 found that the 28,500 acres of recreation lands in New York represent only 65% of the public land needed to meet the existing recreational demand. Ontario is experiencing similar shortages of available recreation. Public lands are in abundance in the Ontario portion of the basin, but the areas are not easily accessible to the urban dwellers concentrated along the western shoreline and not adequately developed for intense use.

Many issues can be brought forward to explain recreation demand increases and how to meet the future land requirements, but the tendency toward uncontrolled population growth and excessive and wasteful energy-resource use undermine attempts to plan for the future. Until this growth problem is confronted, or until people individually come to grasp with the inconsistencies in this present short-sighted attitude, there is little hope for long-term planning. Immediate recreation needs can be met with the present supply of land for public use. The state of technology is capable of managing areas intensively and could remove many of the scars man has placed on the environment. The 1971 Great Lakes Basin Framework Study, Appendix No. 21 lists the recreation problems as "competing land use, high land costs, complex ownership problems, public opposition toward legal restraints attached to reservoirs and associated recreation facilities, inadequate funds and competition for the tax dollar, highway congestion and overuse of certain parks, environmental disturbances by off-the-highway vehicles, physical and legal barriers to deny access to existing and potential recreation lands, multiple activity incompatibility, inadequate area supervision, inadequate stress on environmental education, and inadequate government-citizen involvement in the planning and decision-making process." Most of these problems could be solved through a strong publicity-education program which would result in publicly-directed legislation. An important immediate measure is to secure the rapidly disappearing natural areas important to wildlife (the focus of all outdoor experiences) and useful for recreation development. Access to recreation areas is the issue causing most of recreation's problems. Judicial precedents to solving problems where private interests were preventing access to public waters are discussed by Dewsnup (1971).

Many in-depth studies are available on recreational plans and land capability for many individual watersheds and for regional governments. The U.S. Army Corps of Engineers, U.S. Water Quality Office of the Environmental Protection Agency, U.S. Bureau of Outdoor Recreation (B.O.R.) and conservation authorities of Ontario are responsible for much of the background data and local planning for future water and land recreation needs.

Outdoor recreation activities were mentioned one-sixth of the time in a 1959-60 U.S. national survey on the use of leisure time (B.O.R., 1967). A 1962 survey (Great Lakes Basin Framework Study Append. 21, 1971) indicated one-fifth of all free time in the Great Lakes Basin was devoted to outdoor recreation activities. Clawson (1963) estimates 7% of our leisure time is spent in outdoor recreation. Shortening and shifting the work week is increasing the opportunity for outdoor activities. The industrial work week in the U.S. in 1960 was 39 hours and is estimated at 36 hours in 1976 (U.S. B.O.R., 1967). Canada's work week is presently 35 hours (Table 1).

In 1960, the annual recreation demand for the southern portion of the basin was estimated 72% devoted to summer activities; and 43% of the yearly demand for water-based activities (B.O.R., 1967). This study also estimated that of the 2 1/4 million annual vacationists, the average vacationist in the southern basin stayed 6.4 days of the average party size was 3.7 people. The other segment of the recreation market was the summer resident living in cabins or cottages adjacent to a lake or stream. The greatest concentration of these summer homes was in Jefferson County, New York.

Recreation activities are assessed by grouping them as land-based water-oriented, land-based general, water surface, winter, and other (Table 2). Land-based water-oriented activities occur on land but are generally enhanced by water, land-based general activities are not water dependent, water surface activities are water dependent, winter activities are dependent on snow and ice cover, and other activities are those where the participant assumes a passive role.

The administrative agencies of outdoor recreation around Lake Ontario are so fragmented that little coordination in recreation planning has been attempted except for initial efforts in the last few years. Each governing commission provides a somewhat different type of service; but these types, or functions, are not specifically defined. Presently, there are eight public agencies, along with the private sector, among which there is not adequate coordination. A sound planning base must start with total, coordinated assessment, and studies of needs and demands of the recreation public. The recreation resource agencies in the two countries should cooperate more, at least on an information exchange basis so there is a friendly

working relationship among commissions. Perhaps there could be an all-encompassing, binational assistance program to develop regional recreation facilities and provide joint incentives to encourage private developers to assist in meeting the recreation demand.

Status and Supply

Developed outdoor recreation areas along Lake Ontario are concentrated on the eastern shoreline, and other sites throughout the basin are concentrated in the southern Finger Lakes region, eastern Adirondacks region, and northwestern metropolitan area. Ontario has five different commissions overseeing 88 recreation areas: National Parks (1), Niagara Parks Commission (7), St. Lawrence Park Commission (17), Provincial Parks (9), and Conservation Authorities (53) (Figures 1 and 2). New York's 92 public recreation areas are operated by federal (2), state (54), and local (36) agencies (Figures 3 and 4). Ontario has nearly an equal number of public parks as New York, but Ontario's public lands occupy only 30% of the acreage of New York parks; and 1964-65 visitation was only 33% that of New York (Ontario has 51% of the provincial population in the Lake Ontario Basin) (Table 3). This indicates fewer recreationists are depending on public areas in the northern portion of the lake basin, and there is probably more out-migration to the north and south, whereas in New York there is probably more in-migration from more southern, eastern and northern regions. Recreation surveys on park use in Ontario (Canada Outdoor Recreation Demand [CORD] studies) and New York (B.O.R., 1967) show trends in recreation interest and origin or occupation of users.

The economic background, distance from home, and origin of vacationists are described for users of Ontario parks by Matthews (1969). Other surveys in Ontario are available for 1968 (Travel Data, Ltd. of Canada, 1968) and 1970 (Ontario Dept. of Land Forests, Parks and Recreation Area Branch 1970; Ontario Dept. Environment, Conservation Authorities Branch 1970). A 1960 user survey for New York shows sightseeing, swimming, picnicking, and fishing, respectively, to be the most preferred of 12 water-enhanced outdoor activities (Table 4). Camping was participated in by only 10% of the interviewed vacationists. Demand for these outdoor activities in the New York portion of the basin are reported as activity occasion units (Figure 5). These activity occasions are converted to recreation days by allowing 2.5 activities/average visit (recreation day) to a recreation area. Even though the basic assumptions for these generalizations are questionable, figures are arrived at and can be used comparatively with other estimates to plan and predict. The 1960 annual demand was 35,087,200 recreation days for the New York portion of the basin (B.O.R., 1967). The GLBFS 21 uses a

different list of activities and different assumptions to arrive at a weighted unit value for each type of recreation day. Land requirements are then determined for meeting the future demand using these weighted values. The preference of activities in this 1970 study, based on past-use records, shows outdoor games, swimming, sightseeing and picnicking, respectively, as being in greatest demand of 25 outdoor activities (Table 5).

The water resource is very important in meeting these recreation demands. The natural diversity and abundance of wild animals and plants near bodies of water make any outdoor experience more pleasurable and memorable. For these reasons, along with a host of others concerning land acquisition, many recreation areas are located along waterways. Of the 358 publicly owned recreation areas in the southern portion of the basin, 82% of the areas are water dependent or are located by water (B.O.R., 1967). Eighty-seven percent of the private campgrounds in the same region are located along water bodies. Of the 54 State parks, 41 are located within 10 miles of Lake Ontario (New York Department of Conservation, 1972). The importance water has played in the location of recreation areas is also seen in the location of camps and lodges in Ontario (Figure 6).

Outdoor activities such as outdoor sports and picnicking are provided for in most general recreation areas, so the following discussion will pertain to the activities requiring more intense planning efforts such as swimming, boating, camping, hiking, winter sports, and sightseeing.

Swimming

Swimming is very dependent on the weather in the northern climates, but this sport is by far the most important water associated activity. Results of a 1965 survey showed 75% of the campers in the Thousand Islands State Parks (New York) would not stay at these parks if swimming facilities were not provided. Many types of areas throughout the basin are presently available to swimmers, but many public areas are becoming overcrowded. Public access to lakefronts is often restrictive because water pollution has fouled many beaches. Potential beaches along Lake Ontario are limited because of the local topography. There are about 35 miles of beaches on the New York side and more in Ontario (Figure 7). Unfortunately, the Ontario population is concentrated in the western end of the basin and most beach areas are in the eastern part, where 72% of the total usable lake shoreline occurs. Recreational waterfront developments near metropolitan areas are getting greater attention. The water quality in these areas is often prohibitive to swimming, but many types of surface activities are once again made possible by ensuring public access and attractive

parks. Such developments are completed, or under development, in Toronto, Hamilton, Port Credit, and Mississauga by the respective regional conservation authorities.

Angling

Angling in the Lake Ontario Basin offers a variety of cold-water salmonid streams and lakes, and many smaller ponds with warmwater fisheries of bass, pike, walleye, and perch. Fishing intensity is becoming increasingly bothersome for the "purist" trout fisherman as well as for the casual fisherman. As fishing demands continue to increase, more intensive management and development of some new areas will be necessary. The nature of the sport fishery will be dealt with further in a subsequent section.

Boating

Recreational boating opportunities in the Lake Ontario Basin are superior to those in any of the other Great Lakes (N.Y. B.O.R., 1967). At 56% of the N.Y. publicly owned recreation areas located near water, boating is available to the vacationer. Launching sites are found throughout the basin in New York (Figure 8) and Ontario (Figure 9). The New York Barge Canal provides 524 miles of navigable water connecting the Niagara River and Lake Ontario with the Finger Lakes, Oneida Lake, the Mohawk River and Atlantic Ocean. This route has opened up oceanic yachting opportunities to much of central New York . The St. Lawrence River also offers excellent boating and yachting areas. Additional Ontario waters developed for boating include the Trent-Severn Recreational area east of Lake Simcoe and the Bay of Quinte in Lake Ontario. The extensive planning going into the Trent-Severn recreation corridor will offer a wide variety of recreational opportunities to the Toronto region (Rideau-Trent-Severn Study Commission, 1971).

Camping

Camping interest has spread rapidly in the last few decades, and private developers are starting to meet the market with which public parks have failed to keep pace. Public camping areas are found in less than 5% of the Ontario 54 Conservation Authority areas (a total of 655 campsites), and in only five of the nine Ontario provincial parks (a total of more than 1512 campsites). The Niagara Parks Commission is generally restricted to historic and scenic areas with limited picnic facilities for tourists. The Thousand Islands area of the St. Lawrence River is very popular with campers. The fourteen St. Lawrence

Commission parks contain 2350 camping and trailer sites; and the national park, only .4 sq. miles in area, has more than 100 campsites. The origin of 1963 campers in Ontario provincial parks in the basin varied from about 1/8 to 1/3 U.S. citizens and 1/3 to 1/2 Toronto metropolitan residents (Figure 11). In parks administered by the St. Lawrence Parks Commission, 50% of the 1971 campers were Ontario residents, 36% from Quebec and about 13% from the United States (Arthurs, personal communication). The types of camping equipment used in these areas were tents (38%), tent trailers (36%), house trailers (18%), camper backs (4%), and mobile trailers (2%). Camping facilities in the New York portion of the basin are found in 62% of the state parks (3189 campsites in half the parks) and 22% of the local parks have camping facilities (U.S. B.O.R., 1967 and N.Y. Dept. of Conservation, 1972). These data show that Ontario provincial and, in particular, conservation authority park agencies in the basin are less concerned with meeting camping demands than are St. Lawrence or New York public park agencies. The distribution of all public and private camping areas in the Lake Ontario Basin appear in Figures 1, 2, 3, 4, 6, 10 and the size and services of these areas are found in Ontario Dept. of Tourism and Information, Ontario Dept. of Lands and Forests (Parks Branch 1969); Rand McNally, 1972, and the New York Department of Commerce (1971).

Hiking

Nature paths and hiking trails are getting increasingly greater use and many local-concern groups are contributing greatly to trail maintenance. Only one provincial park has a nature path, but 55% of the Conservation Authority Parks have paths. In New York, there are nine state parks with nature walks (17%), and many more in county recreation areas. Hiking enthusiasts have access to many exciting trails in the Finger Lakes Region, Adirondack-Appalachian region, and the 450 miles of Bruce Trail along the Niagara escarpment (completed in 1967) (Figure 12).

Winter Sports

Of the winter sports, skating and sledding are in greatest demand and require the least planning. Skiing areas are within a few hours driving of all spots in the Lake Ontario Basin. New York lists a total of 47 slopes, 59 trails, 28 lifts and 22 tows at 17 different locations (Table 6), and Ontario has skiing at 26 different locations (Figure 13).

In a 1965 Survey of skiers' preference by the New York Department of Commerce (U.S. B.O.R., 1967), the "typical" skier prefers chair lifts and moderate slopes, has his own equipment, stays overnight half

the time and considers social activities important in selecting a ski center.

Sightseeing

Travel on scenic highways is the preferred recreation of many vacationists (Table 2). With the development of a rapid expressway system, much of the commercial and business traffic has been transferred away from the older roadways. These older routes often blend excellently with the landscape and pass through areas with real local flavor and scenic overlooks. Many of these routes could be easily reconditioned and updated to handle tourist traffic. The designated scenic parkways include the Lake Ontario State Parkway and Robert Moses State Parkway in New York State, and the Niagara Parkway and Long Sault Parkway in Ontario. Other suggested routes in the Thousand Islands area are 31 miles of highway 33 to Kingston, a 34 mile drive from Gananoque to Brockville, and a 35 mile drive on Highway 2 from Brockville to Morrisburg (St. Lawrence Park Commission 1972).

Present Demand and Predicted Requirements

Before planners begin speculating on future demands, extensive surveys must be conducted to determine the characteristics of the recreationists and which activities are preferred. Decisions must also be made about the availability of the resource to the various segments of the public. In our rapidly changing society, predictions beyond 10 - 20 years are on very shaky ground.

New York

Comprehensive plans for New York State and the U.S. Great Lakes Basin have not had available adequate preliminary information on recreationists before projecting recreation demand. Efforts in assessing recreationists' characteristics and preferences are usually done in a piecemeal fashion and little regional coordination has been attempted. A 1970 household survey of recreation preferences was compiled for New York State (N.Y. Dept. of Conservation 1970) but was not available for this report. The U.S. B.O.R. (1967) report presents many studies on individual parks and includes a complete listing of recreation facilities in the southern basin. This study is rapidly becoming out-dated and progression to the next stage, specification of areas to be developed and final planning, was neglected. The GLBFS 21 uses different demand estimates and proposes specific developments to meet the predicted requirements. These predictions,

like the U.S. B.O.R. (1967) estimates, are based on the dubious assumption of continued growth at present rates and makes projections for resource requirements up to 2020 for 5 study areas in the southern basin (Table 5). The projected demand and suggested developments are described in Appendix A. A more attractive prediction base is described by Kalter and Gosse (1970) in a mathematical model for 15-year demand projections. The data based on 1960 and 1965 surveys on five selected activities in eight regions in New York State are used to estimate demand in 1985 (Appendix B). Other recreation studies for New York (Volmer, Ostrower Assoc., 1966) use a different set of activities, regional divisions, and basic assumptions so comparison of these different projected recreation demands are nearly impossible.

Ontario

Commissions providing Ontario's public with outdoor recreation are widely dispersed (Table 3); and except for the last few years, there has been very little planning coordination among them. The primary functions of the different agencies appear to be: provincial parks for water dependent activities, picnicking and some camping; conservation authority parks for picnicking, water dependent, and some winter sports; St. Lawrence Commission parks (established in 1961) for camping, water dependent activities, historic, and sightseeing; National Park (established in 1914) for camping and water dependent activities; Niagara Commission parks (established in late 1800's) for historic sightseeing and picnicking. Descriptions of these facilities and agencies can be found in Table 3 except for St. Lawrence Commission parks (found in St. Lawrence Parks Commission 1971). In most recent years, some agencies have extended their efforts to other areas such as waterfront plans, fishery management and forest management; and more agency cooperation may be desirable if inefficient duplication or ill-advised development is to be avoided.

Progressive planning in the last five years has resulted in more comprehensive assessment of public and recreationist preferences; assessment of present recreation facilities; research on methodology and techniques such as origin models, destination models, and patterns of participation; and distribution of information. Canada Outdoor Recreation Demand (CORD) study is nationwide and is computerized in central data banks. A summary review of the CORD study says:

"Phase I of CORD deals with an extensive collection of data on Outdoor Recreation. It is a Federal-Provincial cooperative effort that will terminate in April 1972. By April 1972, data will have been collected, edited, documented; and as well, preliminary

tabulations and copies of data will have been catalogued and returned to the provinces.

Phase II of CORD began in the summer of 1970 and began to take on its final "federal" form with the establishment and staffing of the Outdoor Recreation Research Section, (ORR), during the summer and early fall of 1971. In line with the Branch Policy Statement, (concerning CORD Phase II), the goal and purpose of the ORR Section is to develop, study and apply methodologies. The ORR Section is concerned with research leading to benefits for planning and planners."

"Continuing work going on into 'Phase III' related to CORD, will largely be carried on by the Outdoor Recreation Research Section (N.P.S.-Planning Division) at the Federal Level. Two primary functions deserve discussion:

1) Carrying on research in the supply of and demand for outdoor recreation; and

2) Creating and carrying on a liaison that will encourage outdoor recreation research.

"CORD data is being used in planning considerations by the Planning Division in work related to the comparison of two potential National Park sites on Georgian Bay, Ontario. As well, 'projection' work on the Pukaskwa National Park planning program has been undertaken. Phase II work being carried out by the ORR team's operations research specialist is critical to executing planned analysis on the projects mentioned above."

"The value of the CORD data in planning for outdoor recreation projects is justification for continuing recreation research studies by all levels of government. According to United States experts, the CORD data offers the solution to 'demand' problems that are extremely important and yet have not been solved by incomparably higher research dollar expenditures for research in outdoor recreation in the United States."

A list of references from the CORD study is found in Appendix C.

Summary

Joint or cooperative management of the outdoor recreation resource of the Lake Ontario Basin would be advantageous for (1) encouraging coordination among governmental agencies; (2) improving communication

channels between recreation administrators and planners in both governments; and (3) improving conditions of inadequate recreation supply in areas along national boundaries where resource potential may be limiting. It is felt that development and maintenance should remain in the hands of the local or state agencies so they can be coordinated with other aspects under the same agency (but outside of the Basin). Regular joint sessions should be held with representatives from each central agency from both nations. These meetings would assist in gaining agreement on the responsibilities of the local-regional agencies to the binational agency. General cooperation might include (1) collecting user data on a common set of outdoor recreation activities; (2) using an agreeable set of internal boundaries (like Ontario Conservation Authority Districts) which allows simple data extraction for the regional agency (which may also have lands outside the Basin) as well as the binational agency; and (3) develop some recreation areas jointly with equal participation from New York and Ontario. The joint agency would be a planning-information agency, not an operating agency. It would (1) extract data from the local agency to evaluate basin recreation supply and demand; (2) provide funds or loans to assist local-regional agencies in approved developments; and (3) compile and distribute reports on the outdoor recreation resource of the Lake Ontario Basin.

General Recommendations

Other programs are described to evaluate the proposed basin plan effectiveness in satisfying the needs. General recommendations for the future management of the recreation resource are:

"1. Emphasis should be placed on providing sufficient recreational opportunities for urban residents, where the most serious imbalances between supply and requirements are found. City and regional parks with the capacity to accommodate large numbers of people and readily accessible to urban residents should provide for much of the heavy use generated by the large centers of population. Many of the city parks should be located within walking distance of the user.

2. Planning, acquisition, and development programs to increase outdoor recreation opportunties for all of the Basin's residents should be accelerated by public agencies.

3. To satisfy the massive requirements emanating from urban areas, regional approaches to resource planning should be expanded to integrate and coordinate recreational planning, development, and management among the local governmental entities.

4. Sufficient monies should be made available to public land-based agencies for acceleration of recreation programs that increase outdoor recreation opportunities and developments.

5. The national, state, and county parks and forests which are currently underdeveloped or undeveloped for recreation should be managed to realize their optimum potential for meeting a part of the Basin's recreational needs. Such development must be compatible with the resource base and the primary purpose of the park or forest.

6. The optimal carrying capacity of recreation areas and related access sites should be determined and they should be managed so as not to exceed that level over long periods of time.

7. Emphasis should be placed on land-use controls to supplement fee simple acquisition, particularly on lands designated as buffer zones and intended for low intensity use. Flood plain and lake shore zoning, deed restrictions, public use liability laws, life tendencies, leases, access easements, and other land-use controls should be used in expanding the recreation resource base on the Basin.

8. Areas and facilities should be developed and managed off-the-road recreational vehicles such as snowmobiles, dune buggies and all-terrain vehicles. Indiscriminate use of such vehicles in non-designated areas should be controlled.

9. Those proposed and potential areas possessing outstanding scenic, historic, and scientific values should be preserved in a national system. Similar areas not qualifying for the national system should be preserved by state and local interests.

10. Trails systems at the federal, state and local levels should be expanded to provide additional recreational opportunities.

11. The private recreation and tourist industry should be encouraged and aided to expand profitable enterprises and opportunities compatible with resource capacity.

12. Public agencies should be responsive to the changing desires and use patterns of recreation participants. Innovative management and development are needed in planning future recreation programs and budgets.

13. Great emphasis and financing should be given to the protection and improvement of private lands through multiple-use management which will enhance outdoor recreational opportunities and developments.

14. The impact of all recreational proposals on the environment should be assessed and properly considered prior to their development.

15. Basic and applied research should be encouraged to provide much needed base data on the many aspects of recreation use, user motivation, and resource management. Origin and destination studies, user preferences, economic studies, resource carrying capacities, and tourism studies warrant consideration." - GLB Framework Study, App. 21.

Table 1

CHANGING WORK WEEK
1870-1970

Year	Work Week in Hours	Leisure Time in Hours
1870	68	16
1900	60	24
1930	48	36
1940	47	37
1950	45.5	38.5
1955	41	43
1970	35	49

From Brook 1970 in Krueger(1970)

Table 2 Outdoor Recreation Activities Grouped by Five Categories

Land-based (water-oriented)	Land-based (general)	Water surface
Swimming	Outdoor games	Boating
Picnicking	Golf	Water skiing
Camping	Bicycling	Canoeing
Nature trails	Horseback riding	Sailing
Hiking, sightseeing		

Winter	Others
Skiing	Driving for pleasure
Sleding	Walking for pleasure
Ice skating	Attending outdoor sporting events
	Attending outdoor concerts

From Great Lakes Basin Framework Study, Appendix No.21

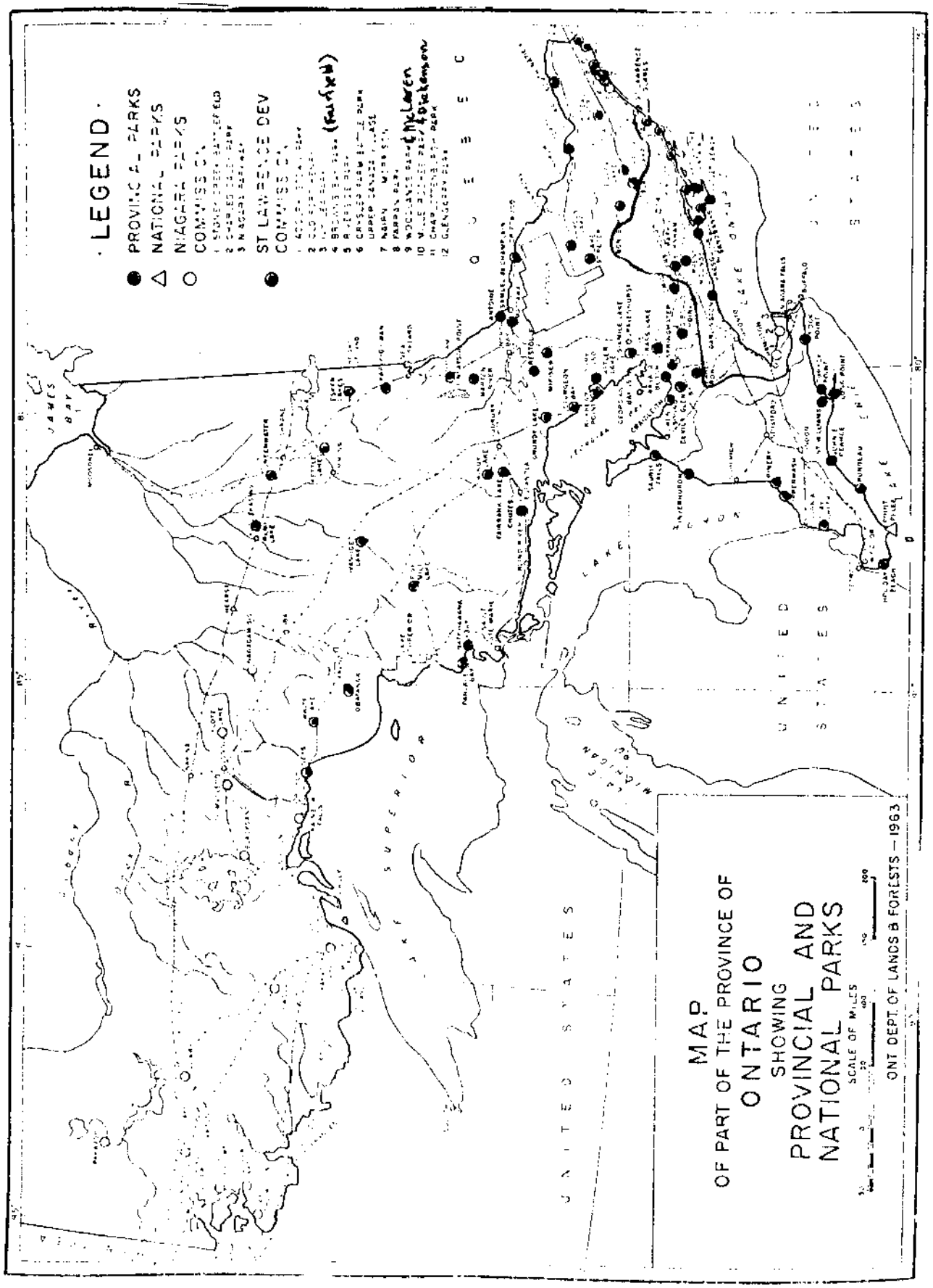


Figure 1. Public Recreation Areas in Southern Ontario

From Ontario Dept. Lands Forests, Ontario Resource Atlas (1963)

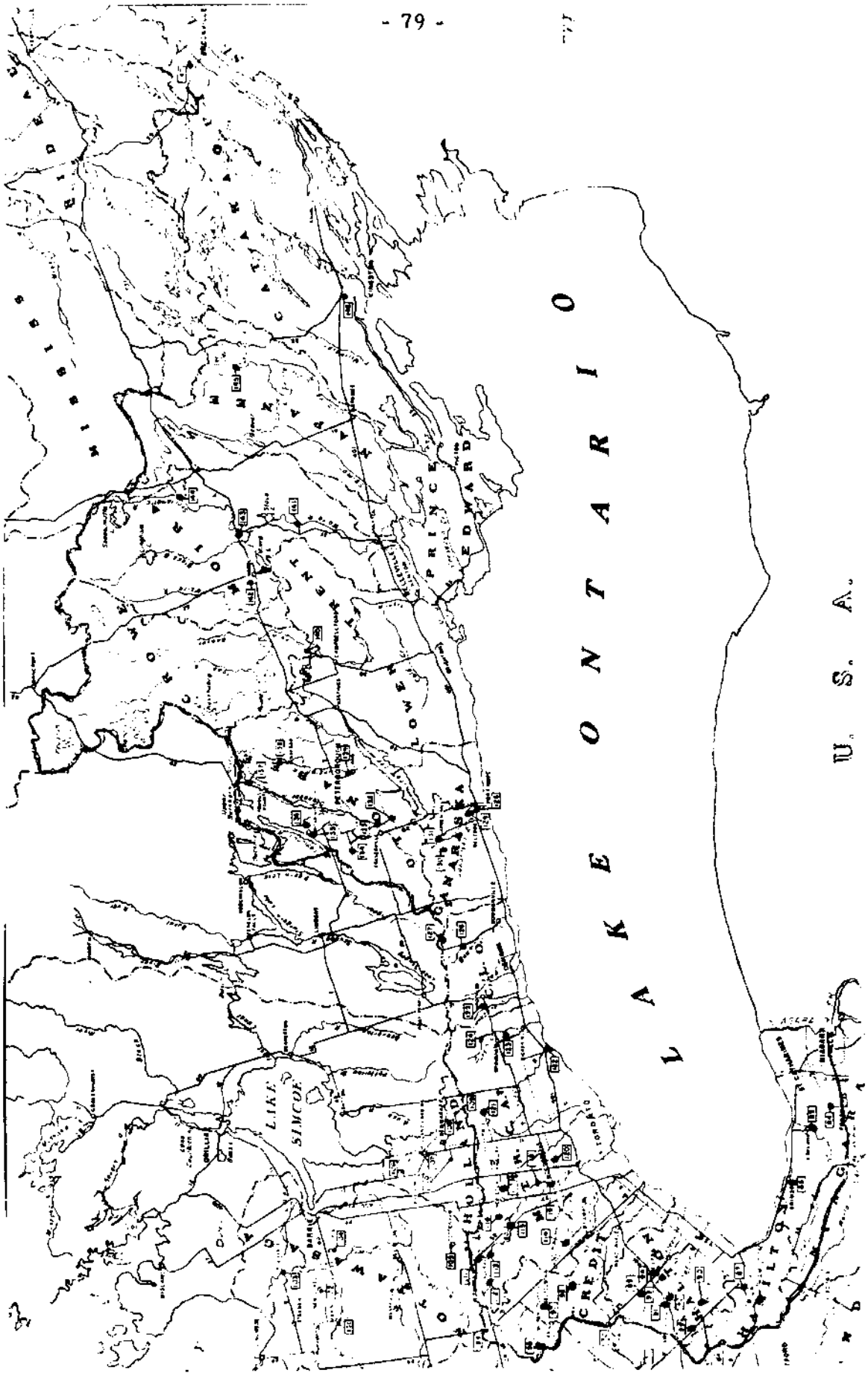
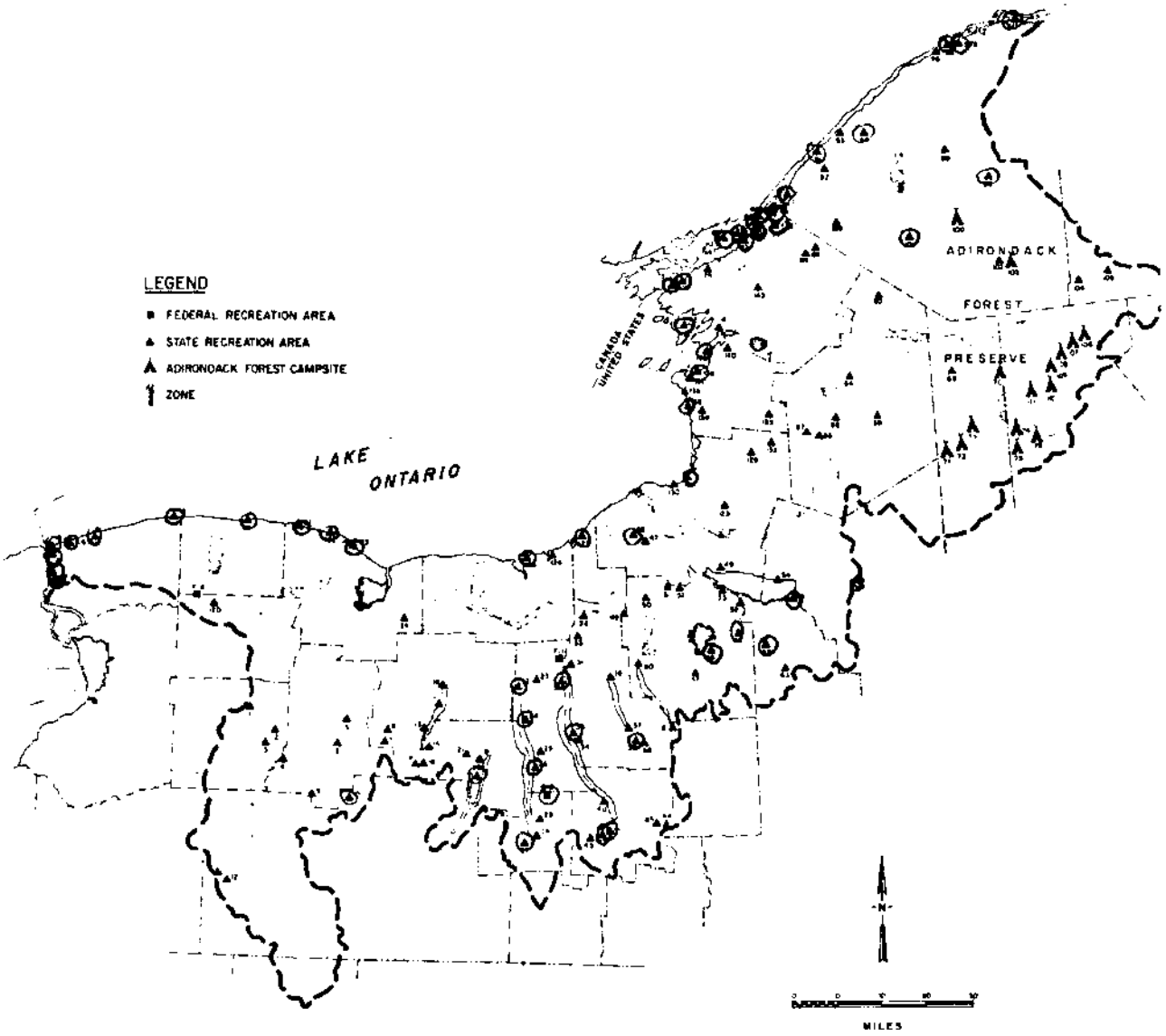


Figure 2. Conservation Authority Public Recreation Areas in Southern Ontario

From Ontario Dept. Energy and Resources Management Guide To Conservation Areas

Figure 3. Federal and State Public Recreation Areas in The Southern Lake Ontario Basin. Areas circled are parks and those not circled are not developed for people use.



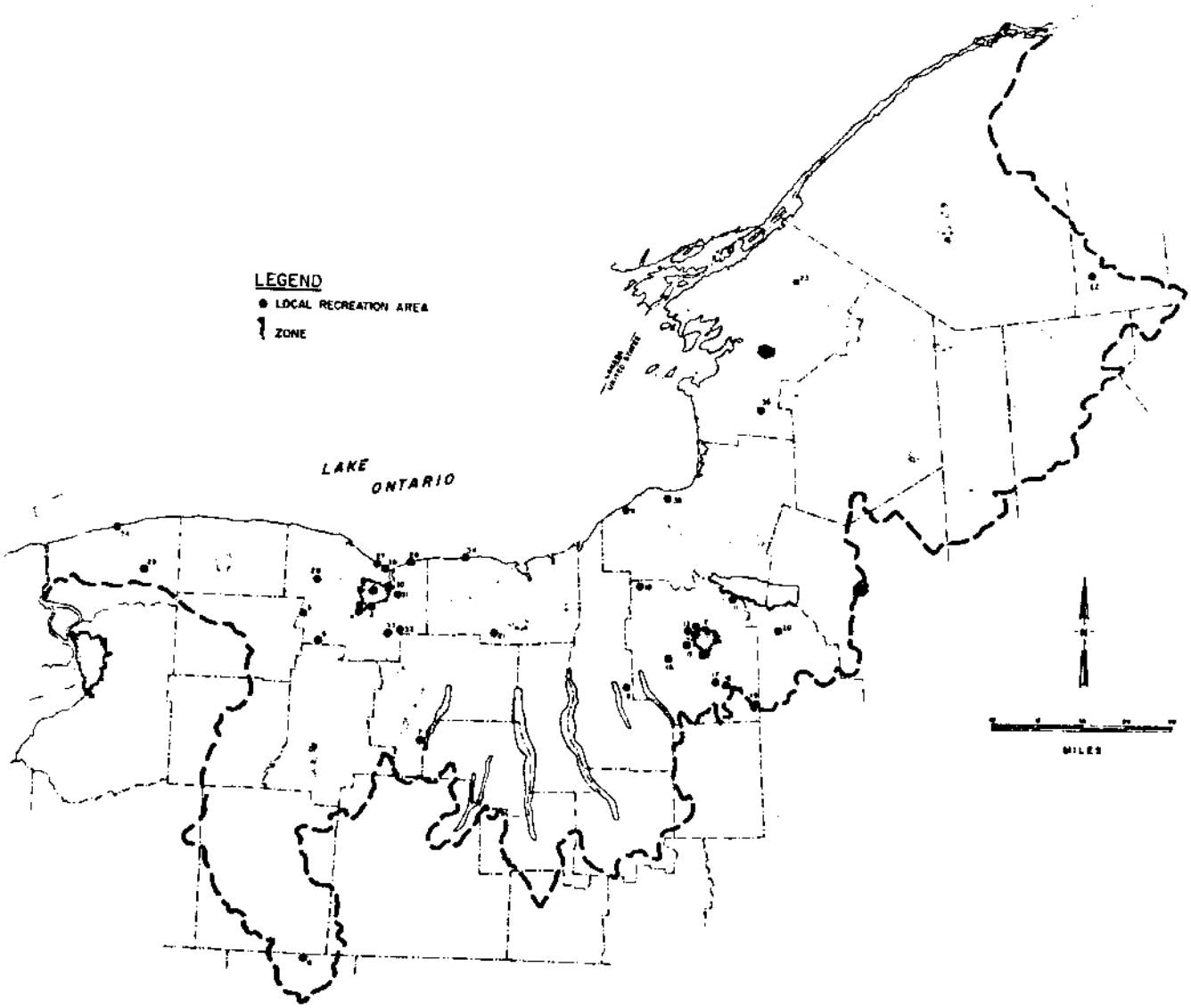
LAKE ONTARIO BASIN

EXISTING FEDERAL AND STATE RECREATION AREAS

with camping

From Department of the Interior
Bureau of Outdoor Recreation (1967)

Figure 4. Local Recreation Areas in the Southern Portion of the Lake Ontario Basin



LAKE ONTARIO BASIN
EXISTING LOCAL RECREATION AREAS

From Department of the Interior
Bureau of Outdoor Recreation (1967)

Table 3. Public Park Size and 1964-65 Visitation in the Lake Ontario Basin and Adjoining Sections of the Niagara and St. Lawrence Rivers

	1 No. Areas	2 Size (Acres)	3 No. of Areas	4 Visitors
Ontario				
Federal Parks	(1)	260[1]	(1)	77,368[1]
Niagara Parks Comm.	(7)	2,800[2]	(5)	400,000[7]
St. Lawrence Comm.	(17)	5,217[3]	(14+)	1,856,772[8]
Provincial Parks	(9)	4,688[4]	(6)	800,000[7]
Conservation Authority	(53)	28,054[5]	(46)	1,282,400[9]
Ontario total	88	38,849	73	4,416,540
New York				
Federal	(2)	13,416[6]	(2)	36,926[6]
State	(54)	104,663[6]	(46)	5,402,881[6]
Local	(36)	12,870[6]	(23)	7,577,294[6]
New York Total	92	130,949	92	13,017,101

Visitation was not reported at all parks as indicated by differences in columns 1 & 3.

[1]Canada Department Northern Affairs and Natural Resources, 1965

[2]Way, Ronald L. 1960

[3]St. Lawrence Parks Commission 1972. Ontario St. Lawrence Parks

[4]Ontario Department Lands and Forests 1970

[5]Ontario Department Energy and Resource Management 1970

[6]U.S. Dept. of Interior, Bureau of Outdoor Recreation 1967

[7]Matthews, G. J. (ed) 1969

[8]St. Lawrence Parks Commission 1972 attendance statistics 1962-1971, 2 pgs. Morrisburg, Ontario

Table 4

DEMAND FOR SELECTED WATER-ORIENTED OUTDOOR RECREATIONAL ACTIVITIES
LAKE ONTARIO BASIN, 1960
(Vacation Sector)

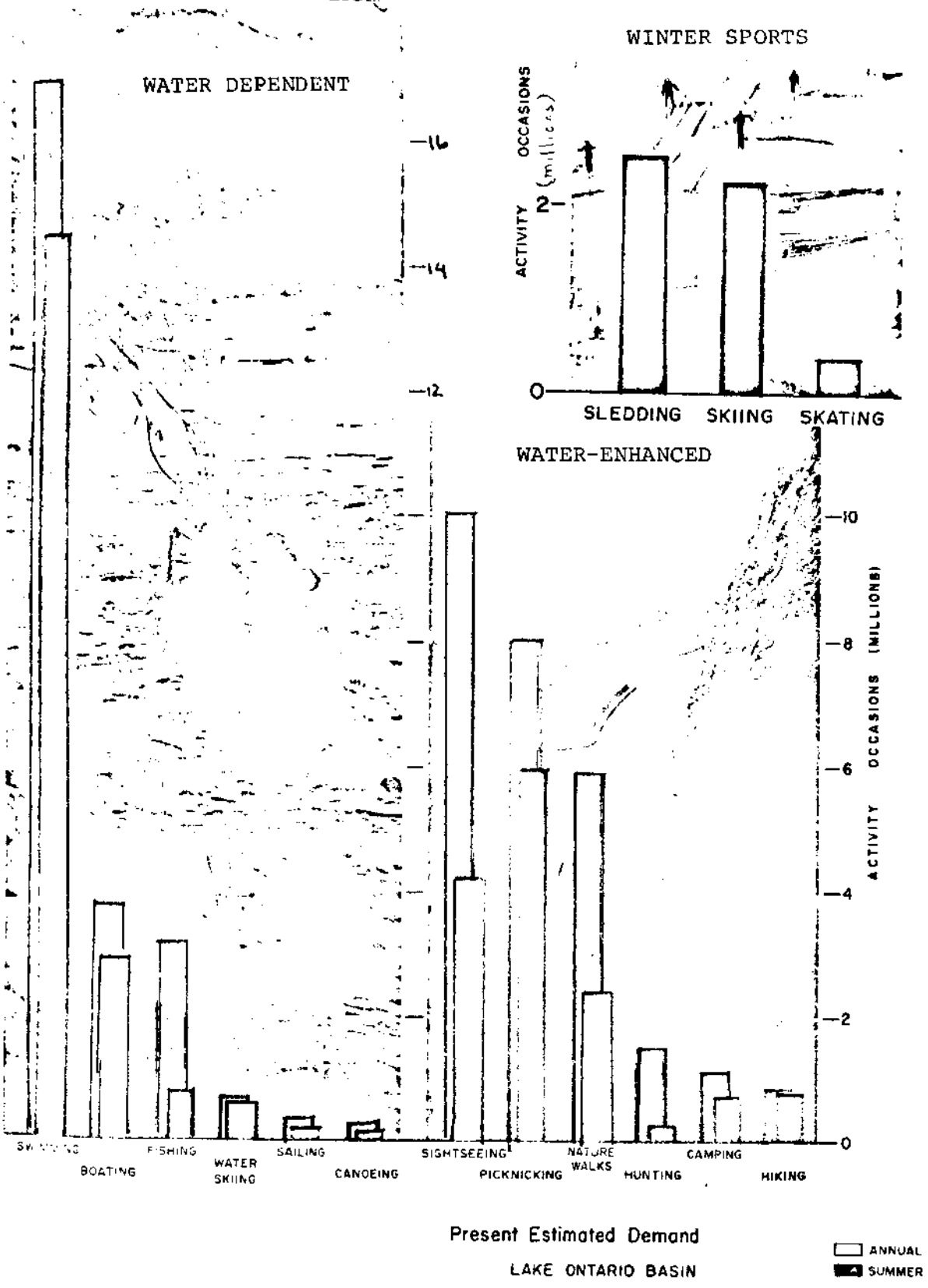
Activity	Percent who engaged in outdoor activities on vacation trips	Column 2 x 14,404,269* activity occasions (1,000's)
(a) Sightseeing	53	7,634
(b) Swimming	38	5,474
(c) Fishing	27	3,889
(d) Picnicking	29	4,177
(e) Boating & Canoeing	19	2,737
(f) Hiking	14	2,017
(g) Camping	10	1,440
(h) Hunting	4	576
(i) Nature Walks	6	864
(j) Horseback riding	3	432
(k) Skiing & Winter Sports	1	144
(l) Took trip but did not engage in outdoor activities	22	3,169
Totals	226**	28,952***

* See result in Step 7.
** Totals to more than 100 because vacationists participate in more than one activity per day.
*** Total does not include activities (j) and (l).

Note: This analysis assumes that those enjoying their vacations while in the basin participated in approximately two activities on the average per day.

From Department of the Interior
Bureau of Outdoor Recreation (1967)

Figure 5. Summary of Recreational Requirements in Activity Occasions (divided by 215 for recreational days) for the U.S. Portion of the Lake Ontario Basin



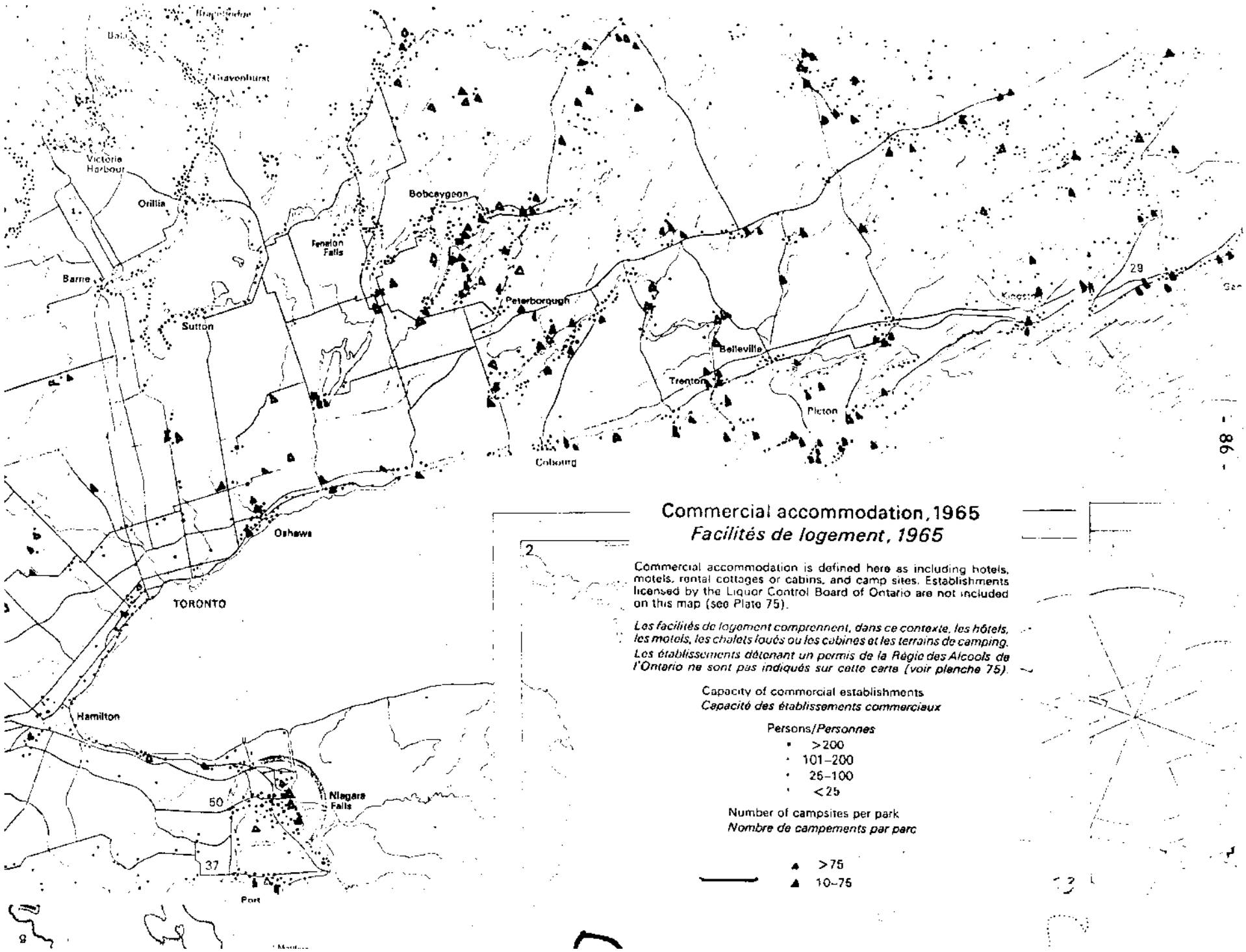
From Department of the Interior

Table 5. Summary of Annual Requirements in Recreational Days by Activity for the U.S. Portion of the Great Lakes Basin (in Millions)

Activity	1970	1980	2000	2020
Land Based-Water Oriented				
Swimming	64.8	94.9	149.0	213.9
Beach Swimming	35.7	52.2	82.0	117.6
Picnicking	38.8	48.9	67.0	91.6
Camping	8.2	13.0	21.2	33.5
Nature Trails	9.4	11.8	15.9	21.7
Hiking	3.9	6.2	9.7	14.3
Sightseeing	44.6	60.2	90.3	132.7
Subtotal	169.7	235.0	353.1	507.7
Land Based-Other				
Outdoor Games	126.3	186.3	314.2	469.0
Golf	13.0	19.0	32.7	47.6
Bicycling	60.7	72.7	98.7	134.7
25% on Public Lands	15.1	18.2	24.7	32.7
Horseback Riding	8.3	10.5	15.2	22.2
25% on Public Lands	2.1	2.6	3.8	5.6
Subtotal	208.3	292.5	460.8	673.5
Water Surface				
Boating	21.9	32.4	51.1	77.2
Water Skiing	3.9	6.9	12.5	20.7
Canoeing	1.4	2.2	3.4	5.2
Sailing	1.3	1.9	3.0	4.9
Subtotal	28.5	43.4	70.0	107.9
Winter Sports				
Skiing	2.3	2.4	3.1	3.9
Sledding	11.2	14.2	22.8	35.7
Ice Skating	9.3	14.6	24.0	37.2
Subtotal	22.8	31.2	49.9	76.8
Other Activities				
Driving for Pleasure	99.3	126.1	169.2	223.7
Walking for Pleasure	75.5	93.5	132.5	185.9
Attending Outdoor Games	29.0	37.9	53.4	74.8
Attending Outdoor Concerts	4.0	5.7	9.0	13.2
Total	637.1	861.3	1,297.9	1,863.6

From Great Lakes Basin Framework Study 21

Figure 6. Private Recreation Accommodations for Camping and Lodging in Southern Ontario



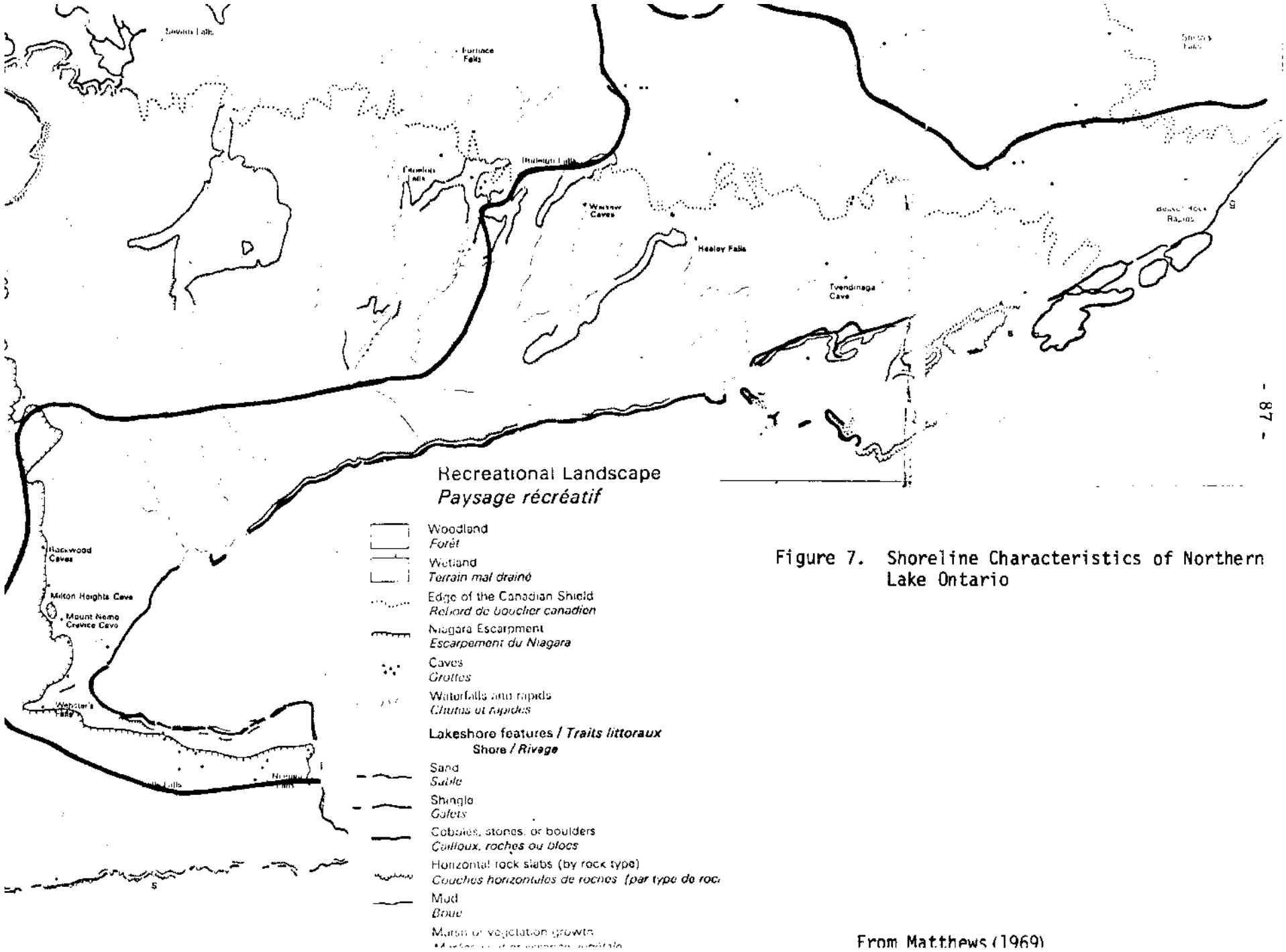
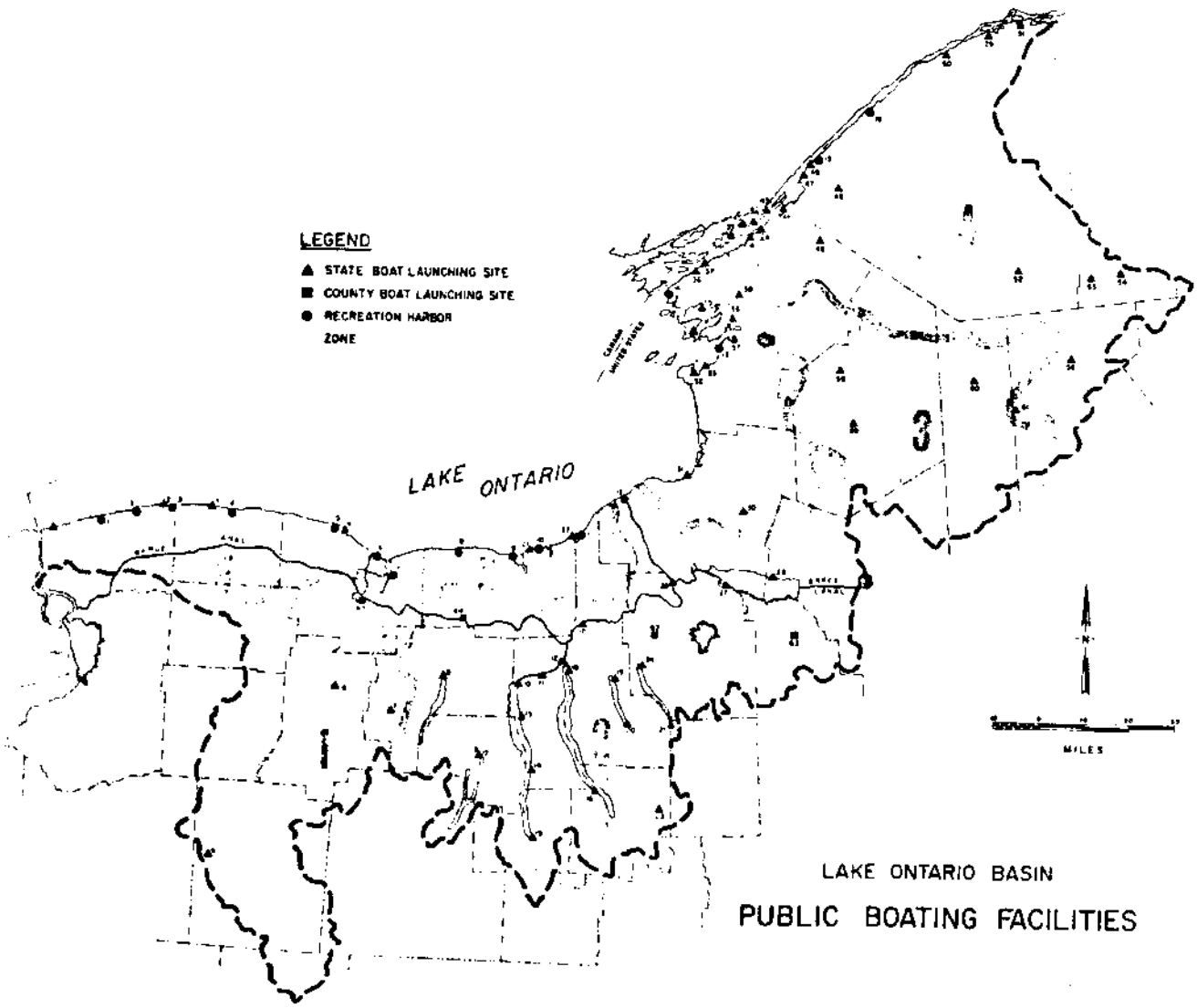


Figure 7. Shoreline Characteristics of Northern Lake Ontario

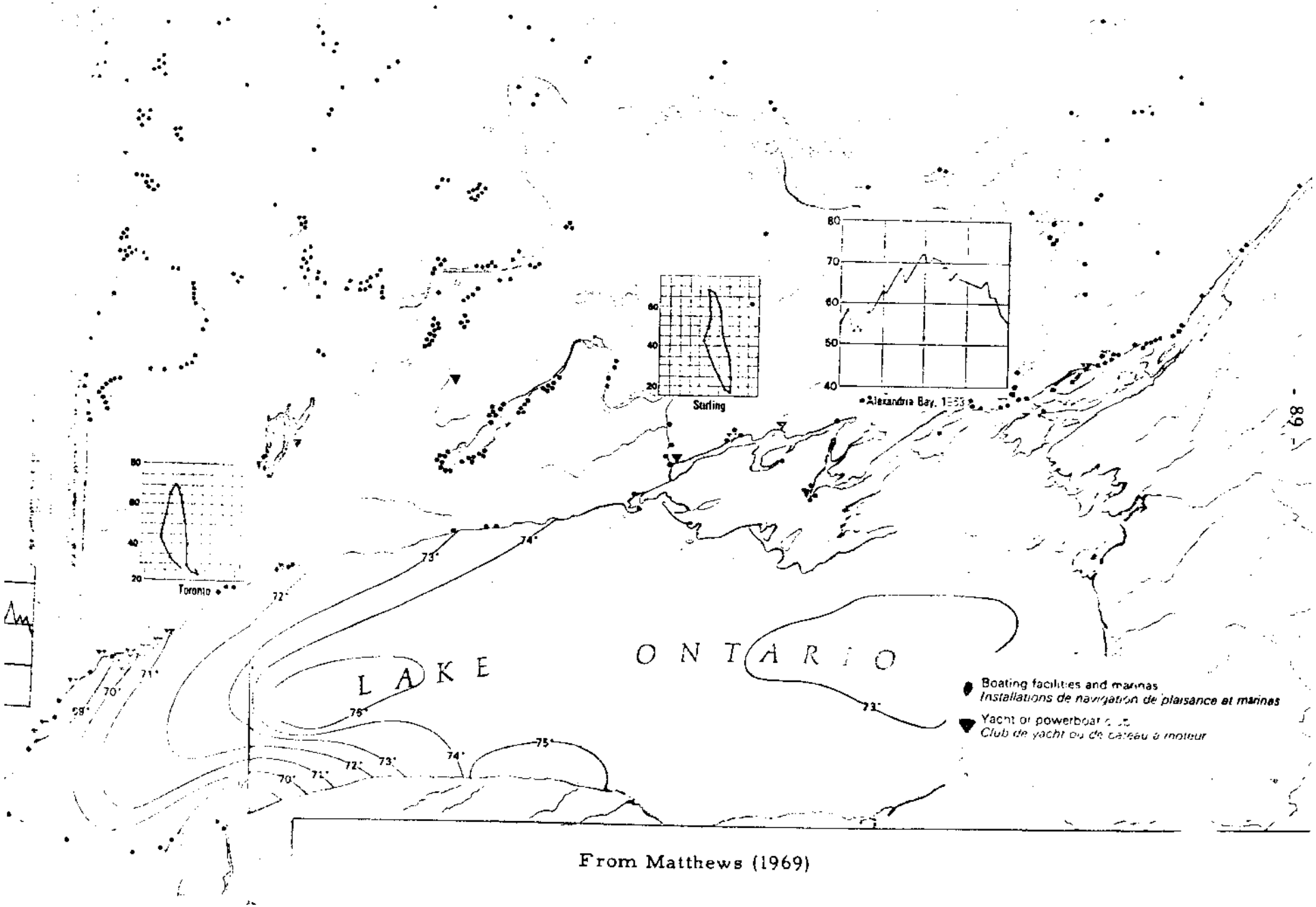
From Matthews (1969)

Figure 8. Public Boating Facilities in the Southern Lake Ontario Basin



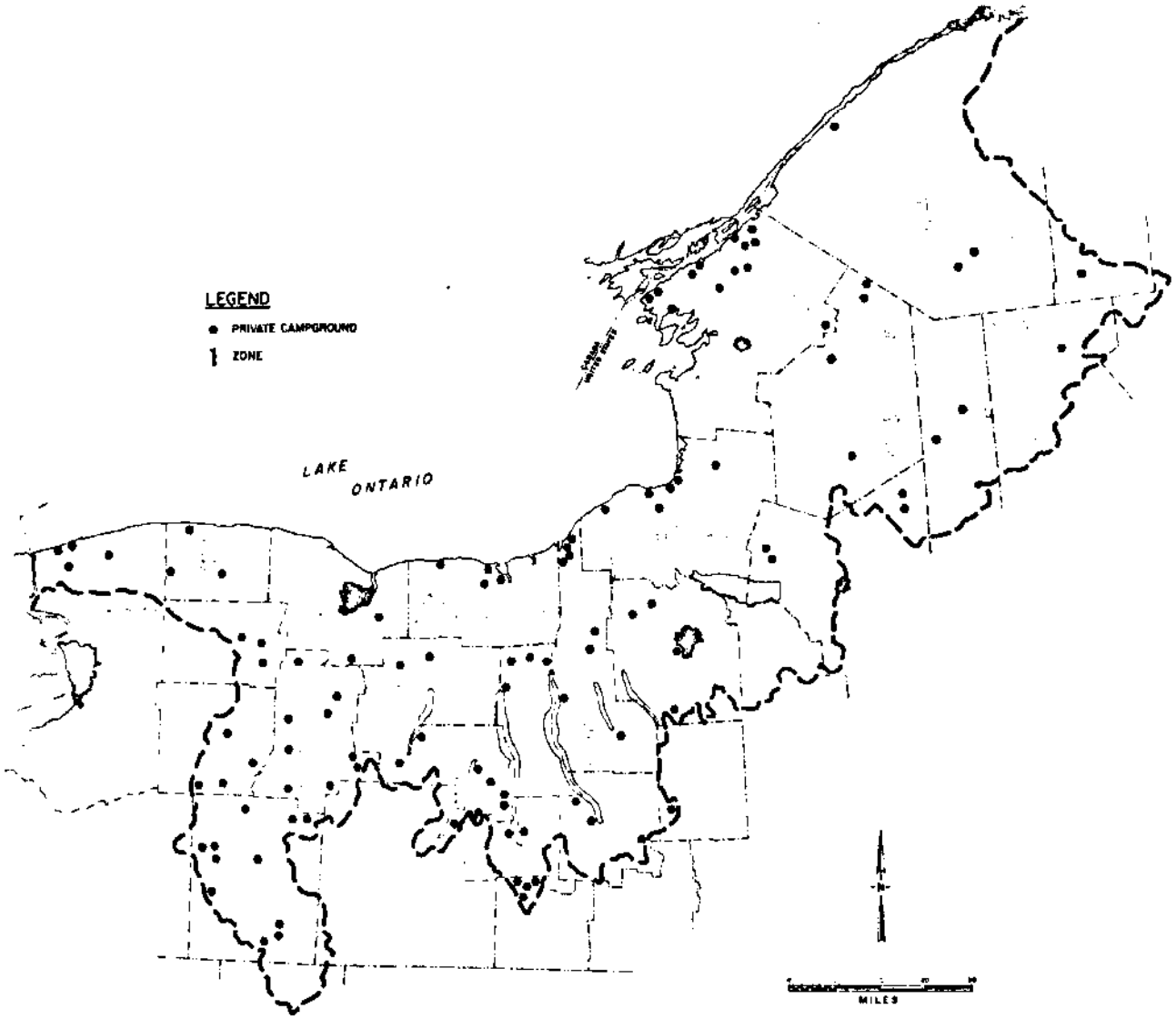
From Department of the Interior
Bureau of Outdoor Recreation (1967)

Figure 9. Boating and Yachting Facilities in Southern Ontario
Temperature isotherms are drawn on the lake



From Matthews (1969)

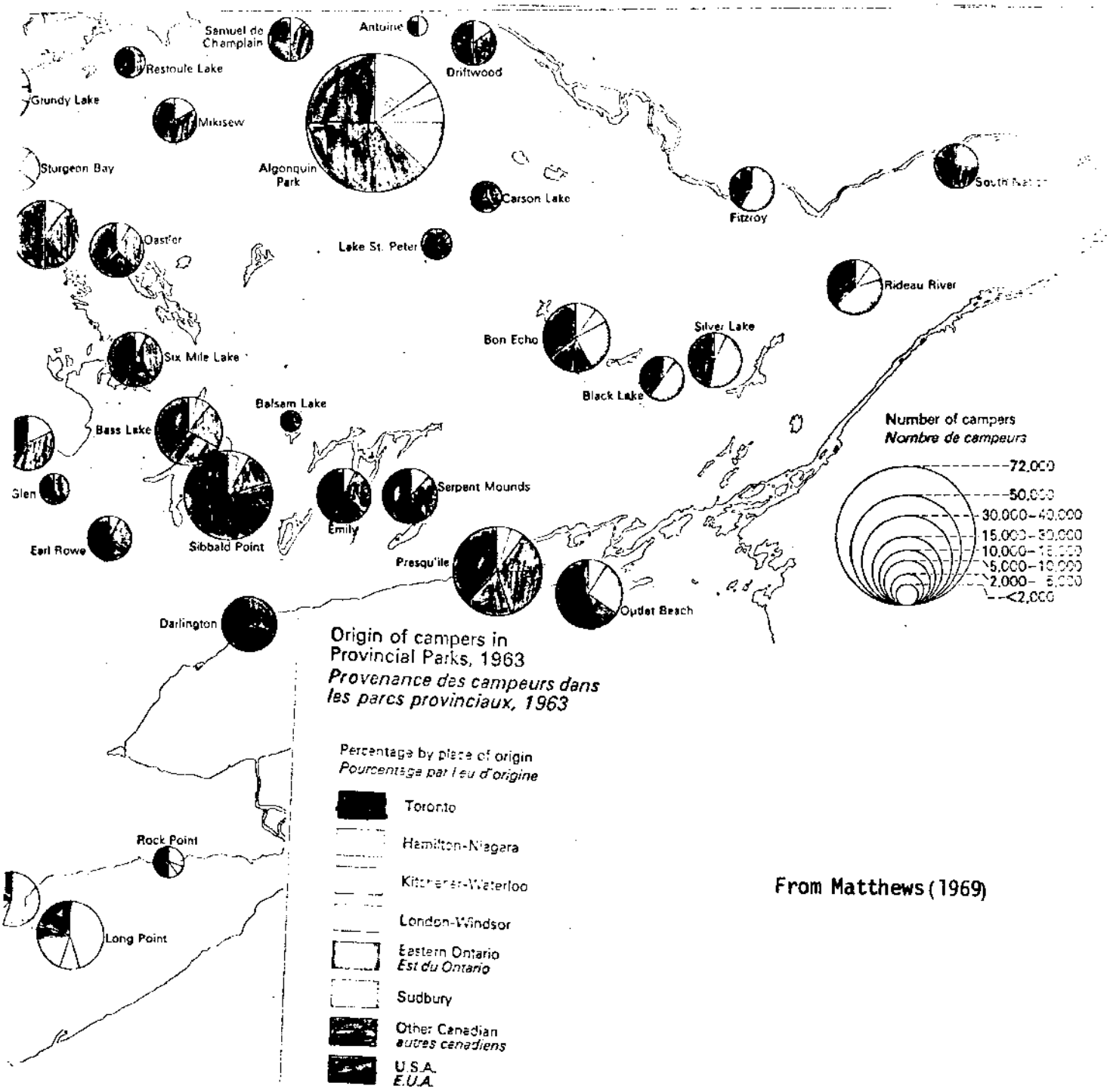
Figure 10. Private Campgrounds in the Southern Portion of the Lake Ontario Basin



111 camp areas with 6,482 camp sites

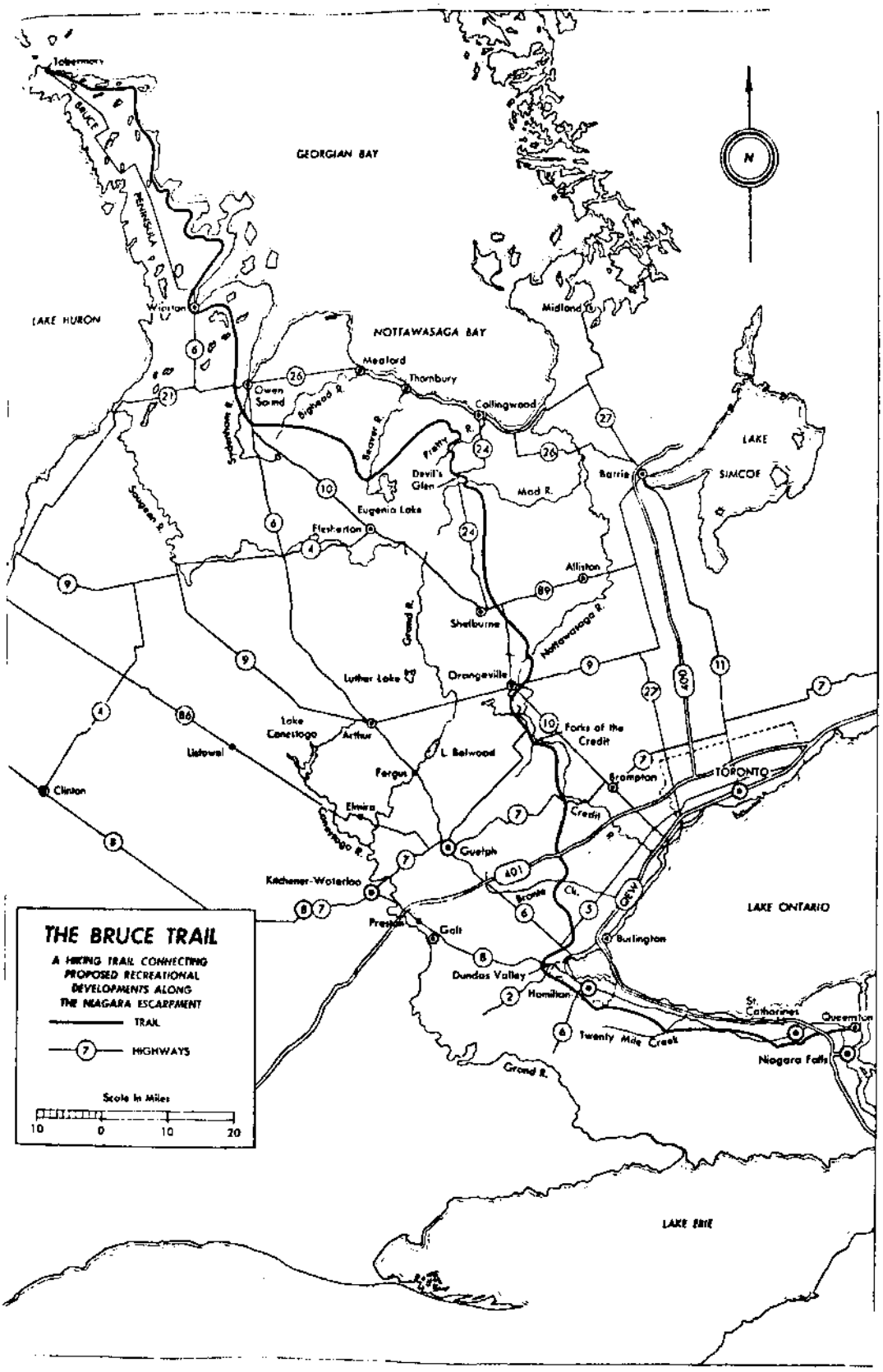
From Department of the Interior
Bureau of Outdoor Recreation (1967)

Figure 11. Origin of Campers in Provincial Parks in Southern Ontario



From Matthews (1969)

Figure 12. Bruce Trail Hiking Route in Southern Ontario



From Pearson N in Krueger et al (1970)

Table 6. Public Ski Centers in Southern Portion of Lake Ontario Basin

Name	Number of Slopes	Trails	Lifts	Tows
St. Lawrence U. Snow Bowl	3	3	1	1
Big Tupper	0	8	2	0
Juniper Hills	2	0	1	0
Dry Hill	3	1	1	3
Old Forge (Maple Ridge)	1	0	1	0
Old Forge (McCauley Mt.)	2	4	2	2
Snow Ridge	6	5	5	0
Hemlock Ridge	1	2	0	1
Mystic Mountain	3	7	2	0
Toggenburg	5	3	3	0
Ninety Acres	2	0	0	2
Drumlins	2	0	1	3
Fillmore	1	2	0	1
Brantling	4	0	1	6
Bristol Mountain	3	4	4	0
Frost Ridge	3	3	0	3
Swain	6	17	4	0
Totals	47	59	28	22

From Department of the Interior
Bureau of Outdoor Recreation (1967)

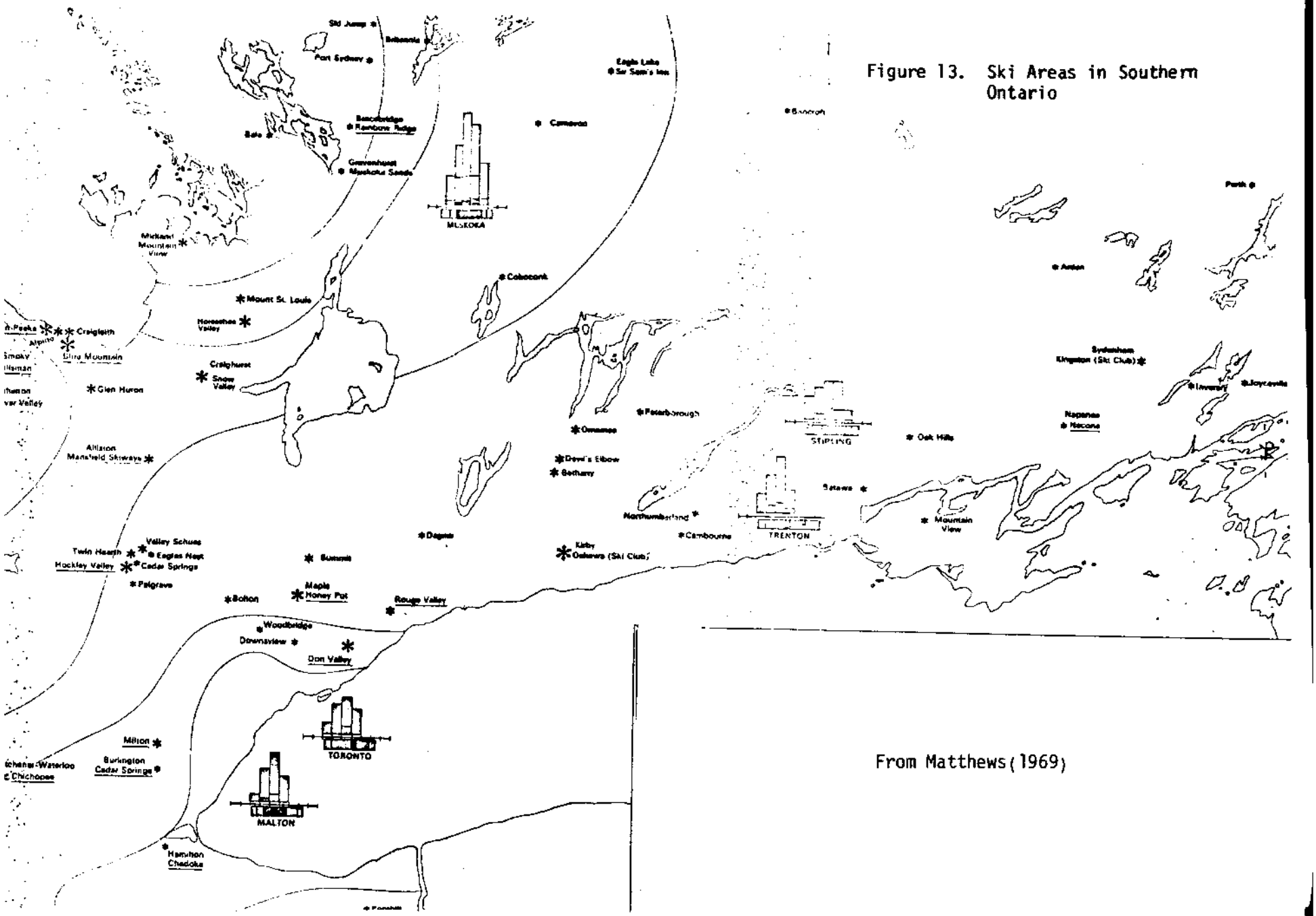


Figure 13. Ski Areas in Southern Ontario

From Matthews (1969)

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PART THREE

Wildlife

Recent organizational innovations have been directed toward international management of the water related resources in the Great Lakes Basin. The wildlife resource, exclusive of plants and fishes, could also prosper from a broader management approach and a larger regional planning unit. As user pressures increase, the user policies will probably change by implementing more non-consumptive uses and by planning for a wider scope of uses and intensity of uses. Man's uncontrolled economic development has been shown to be incompatible with most forms of wildlife. The destruction of wildlife habitat and its replacement with intense monoculture agronomics or usurpation by urbanization or transportation facilities are presaging a dim future for many of the animals so important in our heritage and vital to our recreation and hunting resource. This section makes an assessment of the wildlife resource in the Lake Ontario Basin. The information sources for Ontario Province were not sought out for equal representation, but a general picture is described and the problem areas related thereto.

Of the native animals, waterfowl and other migratory land birds are most affected by management variations between nations. The Lake Ontario Basin borders the Atlantic flyway and is centered about midway between the coastal and Mississippi migratory routes. The North American Migratory Bird Treaty (U.S. and Canada) signed in 1916 laid the groundwork for future regulations and international agreements. The Migratory Bird Conservation Act of 1929 authorized land acquisition in the United States and the Duck Stamp Act of 1934 provided funding. The most important marsh areas managed or to be managed (Figure 1) are: Montezuma National Wildlife refuge; Iroquois; State Oak Orchard; Tonawanda; estuarine regions along Lake Ontario; and marshes in the St. Lawrence River region. Prominent among the Ontario bird sanctuaries and waterfowl hunting areas (Figure 2) is Presqu 'ile, off the northern shore of Lake Ontario. It is noted as a crossover point for multitudes of small birds, waders and warblers (Ontario Dept. of Lands and Forests, 1971). Christie (1971) lists the black duck, wood duck, mallard, blue wing teal and scaup as the most important ducks in the Lake Ontario region. The provincial duck harvest relies most on the mallard, black duck, wood duck, blue wing teal, green winged teal, and ring necked duck, respectively (Ontario Dept. Lands and Forests, 1971). Waterfowl nesting areas are very productive throughout Ontario, particularly in the northern lake region. The giant Canada goose, the largest goose in the world, relied on nesting areas in Ontario until its near extinction. Efforts to restore the flocks have been successful and hunting will again be possible in a few years (Dawson, 1968).

New York

The terrestrial wildlife is abundant throughout the basin. Appendix A describes regional wildlife characteristics and regional hunting areas in the U.S. portion of the basin. In 1960 the forest and farm game habitat covered between 1/4 and 2/3 of each subregion (Figure 3) in New York (Table 1). The Genesee River basin has some of New York's finest agricultural habitat and the St. Lawrence-Adirondack region is richest in forests and wetlands (U.S. Fish and Wildlife Service 1969). Some of the abundant game species include cottontail rabbit, grey squirrel, deer, muskrat, raccoon, and skunk. There is much variation in species and abundance among regions (Table 2). Rare and endangered species, exclusive of fish and plants are also included in Table 2 for each subregion. Natural areas for recreation use in New York are described in Table 3.

The hunting resource in New York is most dependent on deer. License statistics for all of New York State in 1964 show 1.8 times as many big game as small game licenses sold (Table 4). The 1971 big game harvest for the whole state was highest in Yates (3.6 deer/sq. mile), Steuben (3.2 deer/sq. mile), Chemung (3.1 deer/sq. mile), and Ontario counties (3.0 deer/sq. mile) (Anon. 1972). The game animals yielding the greatest return to hunters in the U.S. basin are rabbit and squirrels (Table 5) and the highest hunting success is with squirrel, rabbit and waterfowl (U.S. F.W.S. 1969). Other trends of small game harvest for all of New York State show high success for crow and racoon (Figure 4). Hunting license statistics and projections for all hunters and resident hunters in the New York portion of basin are greatest in the central region (Tables 6 and 7). The fur harvest is very small. Trapping in the Adirondack-St. Lawrence region focuses on the fisher and otter (Table 8).

Ontario

Ontario's wildlife in the Lake Ontario Basin is carefully managed because of the intense localized use. Many of the statistics were not immediately available by regions so provincial statistics are given, with hope that some relative values may be interpreted. The activities of man have been accompanied with extinction and endangerment of many wildlife species. For the whole province, Simkin (1970) lists five kinds of extinct animals and 41 endangered or rare species (24 of these are fishes) (Table 9). Wolves are also rare in most of the southern region (Figure 5).

Much of the province's big game is sought outside the lake basin, but a great majority of the small game and waterfowl hunting occurs in the Lake Ontario Basin. Benson (1961) describes hunter characteristics

and economics in Ontario. The most important small game animals are the snowshoe and European hare, cottontail rabbit, woodcock, grouse, and pheasant. The distribution of pheasants is illustrated in Figure 6, and extensive stocking programs are conducted on provincial shooting areas. Deer are common throughout the southern region (Figure 7), and the average buck size is large (146 pounds) compared to those in other regions (Table 10). Moose are rare to common in the northern portion of the basin (Figure 8), but most hunting probably occurs in the northern lake region. Trapping occurs primarily outside the basin (Figure 9). The income from trapping for the whole province was valued 11 times greater than the Lake Ontario commercial fishery in 1969 (Ontario Dept. of Lands and Forests, 1971). Hunting license issuances for the whole of Ontario indicate a strong interest in small game by the residents (Table 11). Non-resident hunters in 1969 were most interested in moose.

Game Management Areas

Game management areas (public hunting) in the New York portion of the Basin encompass 72,326 acres (Figure 10) and 140,800 acres are in private cooperative game management programs. Many public owned areas are not specifically designated as game management areas, but encompass many acres of good hunting (Table 12). Ontario game management areas (Figure 3) include 7441 acres and 6900 acres are private but managed under cooperative agreements. Hunting demand projections and development plans for Ontario were not available, but the G.L.B.F.S. describes the future plans for the New York portion of the basin (Appendix B).

Recommendations

General recommendations for the future management of the wildlife resource are summarized by G.L.B.F.S. 17 for the U.S. portion of the Great Lakes basin. The problems described, such as overpopulation, loss of wildlife habitat and dangers of toxic materials (pesticides and heavy metals) are characteristic of the Lake Ontario Basin in both New York and Ontario.

The organizations managing these wildlife resources should report to the I.J.C., or whatever binational organization evolves, in a fashion similar to that described for outdoor recreation. Regional subdivisions should be coincident with watersheds and joint meetings should be held regularly to encourage better communication. Waterfowl and other migratory birds are the only group requiring special international arrangements. The treaties and acts have established a working base, and future management must center on

(1) a more even distribution of preserved or restored wetlands and feeding areas and (2) maintaining water levels in marshes bordering Lake Ontario and other waters serving multiple uses. Perhaps other water users promoting water level changes not compatible with waterfowl production should fund water level control structures separating the marshes from open waters. All efforts should be coordinated through a binational organization having at least as much authority and support as the G.L.F.C.

Summary and Conclusions

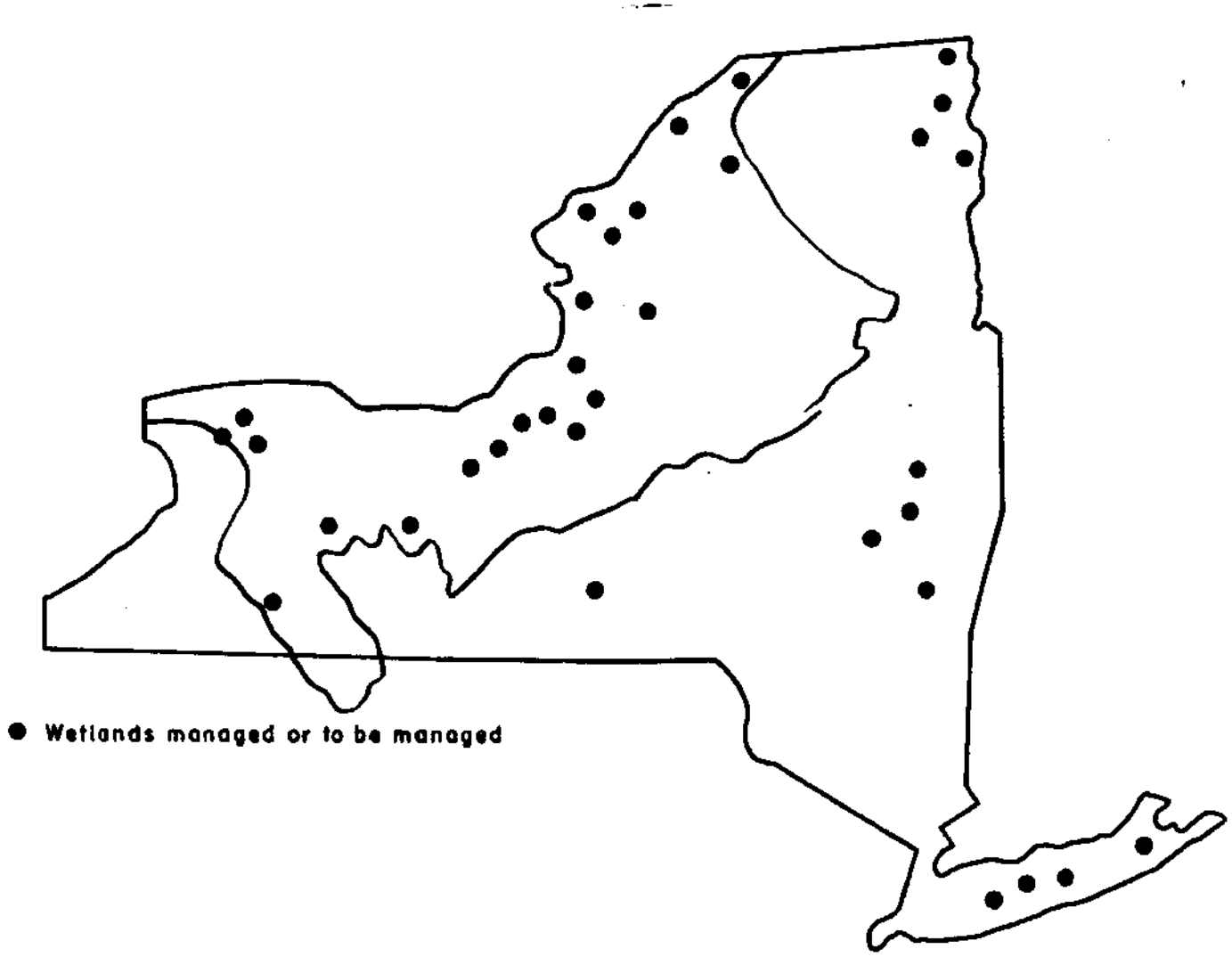
5.1 General

"There is a growing concern among managers of the environment regarding the implications of projected population increases. The future of wildlife is very dim if the population projections over the next fifty years are accurate. Planning procedures intended to provide for wildlife will be "paper exercises" in the event that the population of the Great Lakes Basin is doubled. Optimum population levels have been reached in most areas and far exceeded in many, in considering only the basic human needs of water, air, and food.

The problem for wildlife now and in the future is people. Unless the planning effort is directed toward methods of retarding population growth (such as tax incentives, numbers of persons per acre limits, strict zoning) rather than attempting to accommodate increased population and thereby encouraging increased population, there is utter futility in attempting to provide for wildlife resources. Most important is the probelm of trying to provide an environment of a quality permitting the survival of mankind.

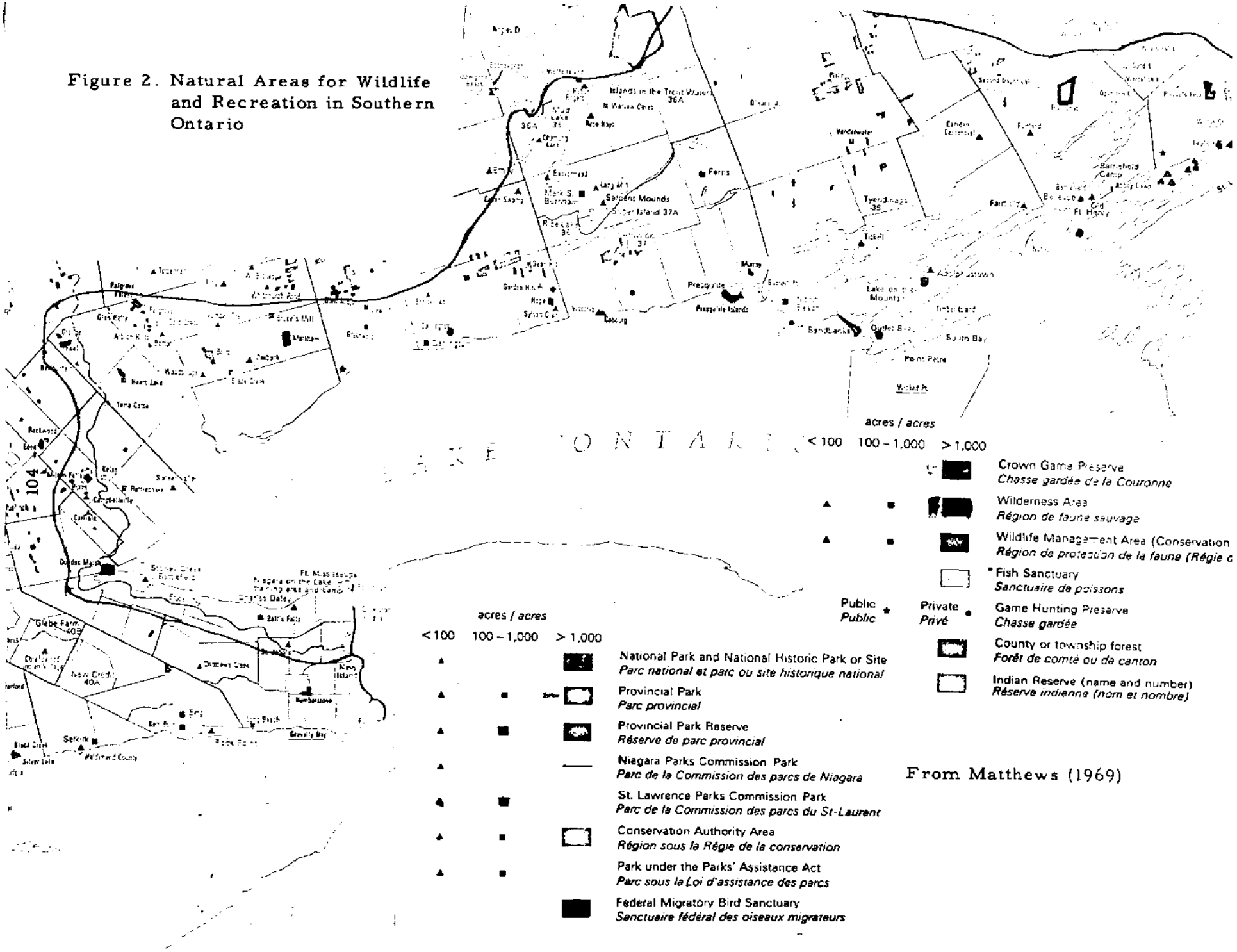
All wildlife problems are directly or indirectly related to the population problems and will become more complicated and more serious in geometric proportion to the population increases in the complexity and magnitude of the wildlife and environmental problems at the target date. In nearly all of the Great Lakes planning areas the demands for consumptive and non-consumptive wildlife uses are projected to be at least double the current demand and in many areas three or four times the current demand. Considering the fact that the total Basin wildlife demand already exceeds the supply and that the supply will be greatly diminished in the future, expecting to accommodate any multiple of the current demand is absurd. All of the available wildlife habitat is needed now. It will not, short of a catastrophic geologic change, be greatly expanded." - GLB Framework Study, App. 17.

Figure 1. Publicly Owned Wetland Areas in New York State



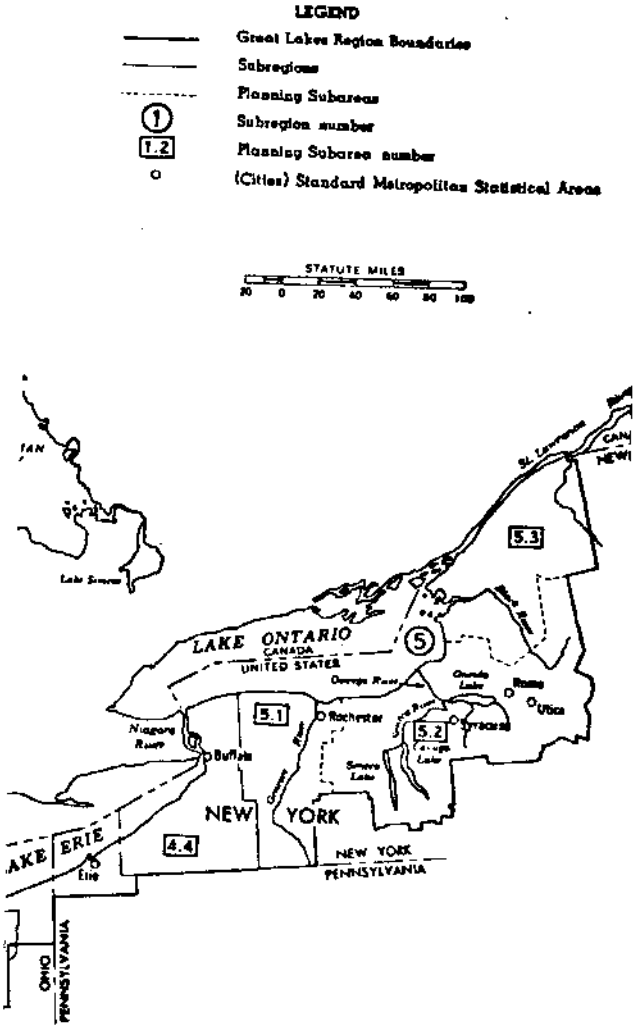
From Benson (1966)

Figure 2. Natural Areas for Wildlife and Recreation in Southern Ontario



From Matthews (1969)

Figure 3. Subregions of the Southern Portion of the Lake Ontario Basin as Described by Great Lakes Basin Framework Study



From Great Lakes Basin Framework Study
Appendix 17

Table 1. Acres of Farm and Forest Game Habitat by Plan Sub Area in New York for 1960

Plan Subarea	Total Land (Acres x 1000)	Total Habitat	Farm	% of Total Land	Forest	% of Total Land	% of Total Land in non-Game Habitat
4.4	3,069.9	2,454.7	1,474,100	48	980,600	32	20
5.1	2,458.7	2,104.8	1,525,700	62	579,100	24	14
5.2	5,427.4	4,970.7	2,909,800	54	2,080,900	38	8
5.3	3,385.6	3,171.6	1,160,300	34	2,011,300	59	7

From Great Lakes Basin Framework Study
Appendix 17

Table 2

NEW YORK WILDLIFE PLANNING SUBAREA 4.4

Wildlife Class and Species	Density				Status		
	Absent	Low	Medium	High	Decreasing	Same	Increasing
Big Game							
Deer			X			X	
Bear		X				X	
Moose	X						
Elk	X						
Turkey		X					X
Waterfowl							
Ducks			X			X	
Geese		X				X	
Small Game							
Cottontail Rabbit			X			X	
Pheasant			X			X	
Ruffed Grouse		X				X	
Squirrels			X			X	
Snowshoe Hare	X						
Sharptail Grouse	X						
Woodcock		X				X	
Mourning Dove		X				X	
Furbearers							
Muskrat			X			X	
Mink		X				X	
Weasel							
Beaver		X			X		
Raccoon			X				X
Otter	X						
Skunk			X			X	
Opossum			X				X
Non-Game							
Woodchuck			X			X	
Porcupine	X						
Fox		X				X	
Bobcat	X						
Crow			X			X	
Rare and Endangered							
Wolf	X						
Marten	X						
Bald Eagle	X						
Osprey	X						

Table 2 (con't)

NEW YORK WILDLIFE PLANNING SUBAREA 5.1

Wildlife Class and Species	Density				Status		
	Absent	Low	Medium	High	Decreasing	Same	Increasing
Big Game							
Deer			X			X	
Bear		X				X	
Moose	X						
Elk	X						
Turkey		X					X
Waterfowl							
Ducks			X			X	
Geese				X			X
Small Game							
Cottontail Rabbit			X			X	
Pheasant				X		X	
Ruffed Grouse							
Squirrels			X			X	
Snowshoe Hare		X				X	
Sharptail Grouse	X						
Woodchuck			X			X	
Mourning Dove			X			X	
Furbearers							
Muskrat				X		X	
Mink			X			X	
Weasel			X			X	
Beaver		X			X		
Raccoon			X			X	
Otter		X					
Skunk			X			X	
Opossum			X				X
Non-Game							
Woodchuck				X		X	
Porcupine							
Fox			X			X	
Bobcat	X						
Crow			X			X	
Rare and Endangered							
Wolf	X						
Marten	X						
Bald Eagle		X					
Osprey							

Table 2 (con't)

NEW YORK WILDLIFE PLANNING SUBAREA 5.2

Wildlife Class and Species	Absent	Low	Medium	High	Decreasing	Same	Increasing
Big Game							
Deer			X			X	
Bear		X				X	
Moose	X						
Elk	X						
Turkey		X					X
Waterfowl							
Ducks			X			X	
Geese				X			X
Small Game							
Cottontail Rabbit			X			X	
Pheasant			X			X	
Ruffed Grouse							
Squirrels			X			X	
Snowshoe Hare			X			X	
Sharptail Grouse	X						
Woodcock			X			X	
Mourning Dove			X			X	
Furbearers							
Muskrat				X		X	
Mink			X			X	
Weasel			X			X	
Beaver			X			X	
Raccoon			X			X	
Otter		X					
Skunk			X			X	
Opossum			X				X
Non-Game							
Woodchuck			X			X	
Porcupine		X				X	
Fox			X			X	
Bobcat		X				X	
Crow			X			X	
Rare and Endangered							
Wolf	X						
Marten		X				X	
Bald Eagle		X				X	
Osprey							

Table 2 (con't)

NEW YORK WILDLIFE, PLANNING SUBAREA 5.3
ZONE: BLACK RIVER VALLEY

Wildlife Class and Species	Density				Status		
	Absent	Low	Medium	High	Decreasing	Same	Increasin
Big Game							
Deer		X				X	
Bear	X					X	
Moose	X					X	
Elk	X					X	
Turkey	X					X	
Waterfowl							
Ducks			X			X	
Geese				X		X	
Small Game							
Cottontail Rabbit			X			X	
Pheasant		X				X	
Ruffed Grouse		X				X	
Squirrels			X			X	
Snowshoe Hare		X				X	
Sharptail Grouse	X					X	
Woodcock		X				X	
Mourning Dove			X			X	
Hun. Partridge	X					X	
Furbearers							
Muskrat				X		X	
Mink				X		X	
Weasel				X		X	
Beaver		X				X	
Raccoon			X			X	
Otter		X				X	
Skunk			X			X	
Opossum		X				X	
Fisher		X				X	
Non-Game							
Woodchuck			X			X	
Porcupine		X				X	
Fox			X		X		
Bobcat		X			X		
Crow			X			X	
Coyote		X				X	
Rare and Endangered							
Wolf	X					X	
Lynx	X					X	
Marten	X					X	
Spruce Grouse	X					X	
Golden Eagle	X					X	
Bald Eagle	X					X	

Table 2 (con't)

See page 4 Appendix A

ZONE: Central Tug Hill

Wildlife Class and Species	Density				Status		
	Absent	Low	Medium	High	Decreasing	Same	Increasing
Big Game							
Deer			X				X
Bear		X				X	
Moose	X					X	
Elk	X					X	
Turkey	X					X	
Waterfowl							
Ducks			X			X	
Geese			X			X	
Small Game							
Cottontail Rabbit	X					X	
Pheasant	X					X	
Ruffed Grouse		X				X	
Squirrels		X				X	
Snowshoe Hare			X			X	
Sharptail Grouse	X					X	
Woodcock		X				X	
Mourning Dove		X				X	
Hun. Partridge	X					X	
Furbearers							
Muskrat			X			X	
Mink				X		X	
Weasel		X				X	
Beaver				X		X	
Raccoon		X				X	
Otter		X				X	
Skunk		X				X	
Opossum	X					X	
Fisher		X				X	
Non-Game							
Woodchuck		X				X	
Porcupine				X		X	
Fox		X				X	
Bobcat			X		X		
Crow			X			X	
Coyote			X			X	
Rare and Endangered							
Wolf	X					X	
Lynx	X					X	
Marten	X					X	
Spruce Grouse	X					X	
Golden Eagle	X					X	
Bald Eagle	X					X	

Table 2 (con't)

ZONE: CENTRAL TUG HILL TRANSITION

Wildlife Class and Species	Density				Status		
	Absent	Low	Medium	High	Decreasing	Same	Increasing
Big Game							
Deer			X				X
Bear		X				X	
Moose	X					X	
Elk	X					X	
Turkey	X					X	
Waterfowl							
Ducks			X			X	
Geese			X			X	
Small Game							
Cottontail Rabbit		X				X	
Pheasant	X					X	
Ruffed Grouse				X			X
Squirrels		X				X	
Snowshoe Hare				X			X
Sharptail Grouse	X					X	
Woodcock				X		X	
Morning Dove		X				X	
Hun. Partridge	X					X	
Furbearers							
Muskrat			X			X	
Mink			X			X	
Weasel			X			X	
Beaver		X			X		
Raccoon			X			X	
Otter		X				X	
Skunk			X			X	
Opossum		X				X	
Fisher		X				X	
Non-Game							
Woodchuck			X			X	
Porcupine		X				X	
Fox			X			X	
Bobcat		X				X	
Crow			X			X	
Coyote		X				X	
Rare and Endangered							
Wolf	X					X	
Lynx	X					X	
Marten	X					X	
Spruce Grouse	X					X	
Golden Eagle	X					X	
Bald Eagle	X					X	

Table 2 (con't)

ZONE: WESTERN ADIRONDACKS

Wildlife Class and Species	Density				Status		
	Absent	Low	Medium	High	Decreasing	Same	Increasing
Big Game							
Deer				X		X	
Bear			X			X	
Moose	X					X	
Elk	X					X	
Turkey	X					X	
Waterfowl							
Ducks		X				X	
Geese		X				X	
Small Game							
Cottontail Rabbit	X					X	
Pheasant	X					X	
Ruffed Grouse			X			X	
Squirrels	X					X	
Snowshoe Hare			X			X	
Sharptail Grouse	X					X	
Woodcock		X				X	
Mourning Dove		X				X	
Hun. Partridge	X					X	
Furbearers							
Muskrat			X			X	
Mink			X			X	
Weasel		X				X	
Beaver				X	X		
Raccoon			X			X	
Otter				X		X	
Skunk		X				X	
Opossum	X					X	
Fisher				X			X
Non-Game							
Woodchuck		X				X	
Porcupine			X			X	
Fox		X				X	
Bobcat			X			X	
Crow		X				X	
Coyote			X			X	
Rare and Endangered							
Wolf		X				X	
Lynx		X				X	
Marten		X				X	
Spruce Grouse		X				X	
Golden Eagle		X				X	
Bald Eagle		X				X	

Table 2 (con't)

ZONE: CENTRAL ADIRONDACKS

Wildlife Class and Species	Density				Status		
	Absent	Low	Medium	High	Decreasing	Same	Increasing
Big Game							
Deer			X			X	
Bear				X		X	
Moose	X					X	
Elk	X					X	
Turkey	X					X	
Waterfowl							
Ducks		X				X	
Geese		X				X	
Small Game							
Cottontail Rabbit	X					X	
Pheasant	X					X	
Ruffed Grouse			X			X	
Squirrels	X					X	
Snowshoe Hare		X				X	
Sharptail Grouse	X					X	
Woodcock		X				X	
Mourning Dove		X				X	
Hun. Partridge	X					X	
Furbearers							
Muskrat			X			X	
Mink				X		X	
Weasel		X				X	
Beaver			X			X	
Raccoon			X			X	
Otter				X		X	
Skunk		X				X	
Opossum	X					X	
Fisher				X			X
Non-Game							
Woodchuck		X				X	
Porcupine				X		X	
Fox		X				X	
Bobcat			X			X	
Crow			X			X	
Coyote			X			X	
Rare and Endangered							
Wolf	X					X	
Lynx		X				X	
Marten		X				X	
Spruce Grouse		X				X	
Golden Eagle		X				X	
Bald Eagle		X				X	

Table 2 (con't)

ZONE: ADIRONDACK TRANSITION

Wildlife Class and Species	Density				Status		
	Absent	Low	Medium	High	Decreasing	Same	Increasing
Big Game							
Deer			X			X	
Bear		X				X	
Moose	X					X	
Elk	X					X	
Turkey	X					X	
Waterfowl							
Ducks		X				X	
Geese		X				X	
Small Game							
Cottontail Rabbit		X				X	
Pheasant	X					X	
Ruffed Grouse				X		X	
Squirrels			X			X	
Snowshoe Hare				X		X	
Sharptail Grouse	X					X	
Woodcock				X		X	
Mourning Dove		X				X	
Hun. Partridge		X				X	
Furbearers							
Muskrat				X			
Mink				X		X	
Weasel			X			X	
Beaver			X			X	
Raccoon			X			X	
Otter			X			X	
Skunk			X			X	
Opossum		X				X	
Fisher			X		X		
Non-Game							
Woodchuck		X				X	
Porcupine				X		X	
Fox			X			X	
Bobcat		X				X	
Crow			X			X	
Coyote		X				X	
Rare and Endangered							
Wolf	X					X	
Lynx	X					X	
Marten	X					X	
Spruce Grouse		X				X	
Golden Eagle		X			X		
Bald Eagle		X			X		

Table 2 (con't)

ZONE: ST. LAWRENCE PLAIN

Wildlife Class and Species	Density				Status		
	Absent	Low	Medium	High	Decreasing	Same	Increasing
Big Game							
Deer		X				X	
Bear		X				X	
Moose	X					X	
Elk	X					X	
Turkey	X					X	
Waterfowl							
Ducks				X			X
Geese			X				X
Small Game							
Cottontail Rabbit		X				X	
Pheasant		X				X	
Ruffed Grouse				X		X	
Squirrels		X				X	
Snowshoe Hare			X			X	
Sharptail Grouse	X					X	
Woodcock				X		X	
Mourning Dove		X				X	
Hun. Partridge		X				X	
Furbearers							
Muskrat				X		X	
Mink				X		X	
Weasel			X			X	
Beaver		X				X	
Raccoon			X			X	
Otter		X				X	
Skunk			X			X	
Opossum	X					X	
Fisher		X			X		
Rare and Endangered							
Wolf	X					X	
Lynx	X					X	
Marten	X					X	
Spruce Grouse	X					X	
Golden Eagle	X					X	
Bald Eagle	X					X	
Non-Game							
Woodchuck			X			X	
Porcupine			X			X	
Fox			X			X	
Bobcat		X				X	
Crow			X			X	
Coyote		X				X	

Table 2 (con t)

ZONE: EASTERN ONTARIO PLAIN

Wildlife Class and Species	Density				Status		
	Absent	Low	Medium	High	Decreasing	Same	Increasing
Big Game							
Deer		X				X	
Bear		X				X	
Moose	X					X	
Elk	X					X	
Turkey		X				X	
Waterfowl							
Ducks				X		X	
Geese				X		X	
Small Game							
Cottontail Rabbit				X		X	
Pheasant		X				X	
Ruffed Grouse			X			X	
Squirrels			X			X	
Snowshoe Hare		X				X	
Sharptail Grouse	X					X	
Woodcock				X		X	
Mourning Dove			X			X	
Hun. Partridge				X		X	
Furbearers							
Muskrat				X		X	
Mink			X			X	
Weasel				X		X	
Beaver			X			X	
Raccoon				X		X	
Otter		X				X	
Skunk				X		X	
Opossum		X				X	
Fisher		X			X		
Non-Game							
Woodchuck			X			X	
Porcupine		X				X	
Fox				X		X	
Bobcat		X				X	
Crow			X			X	
Coyote		X				X	
Rare and Endangered							
Wolf	X					X	
Lynx	X					X	
Marten	X					X	
Spruce Grouse	X					X	
Golden Eagle	X					X	
Bald Eagle	X					X	

Table 3

GREAT LAKES BASIN

NATURAL AREAS IN NEW YORK
AS OF 1969

Planning Subarea	County	Name of Area	Importance	Acres
4.4	Chautauqua	Canadaway Creek G.M.A.	Heron rookery	2,180
	Erie and Cattaraugus	Zoar Valley	Geologic features and unusual flora	3,534
	Erie	Springville Bog	Unusual flora	26
	Niagara	Niagara Power Dam and Niagara Falls	Geologic feature	N.A.
5.1	Allegany	Hanging Bog G.M.A.	Unusual flora, rare orchids	4,340
	"	Moss Lake	Unusual flora	26
	Genesee and Monroe	Bergen Swamp	Massasauga rattler, marl bog-unusual	1,200
	Genesee and Orleans	Oak Orchard Complex	Unusual flora and flora	17,000
	Livingston	Rattlesnake Hill G.M.A.	Timber rattlers	5,150
	"	Danville/Woodville	Unusual flora	N.A.
	"	Caledonia State Fish Hatchery	First fish hatchery in U.S.	
	Livingston & Wyoming	Letchworth State Park	Geologic features and unusual flora	14,337
	Monroe	28 different locations for e.g., south side NYCRR, West of East Lake Rd., Brock Port	Bastard paw paw reaches N.E. limit along Lock Port dolomite escarpment	N.A.
	"	Kennedy's Bog	Unusual flora, Canadian Muskeg	5
	"	Point at Hamlin Beach State Park	Nesting area for bank swallows	1,113
	"	Braddock Bay Marsh	Marsh & ponds-waterfowl & furbearers	

From Great Lakes Basin Framework Study
Appendix 17

Table 3 (con't)

NATURAL AREAS IN NEW YORK

Planning Subarea	County	Name of Area	Importance	Acres
5.1 (Cont.)	Monroe	Zurick Swamp	Waterfowl, furbearers, rattlesnakes & unique plant life	100
5.2	"	Genessee Falls	Scenic value in Rochester	
	"	Devils Nose *	Waterfowl & geologic value	190
	Orleans	East of Hulberton along Barge Canal	Unusual flora, bastard paw paw	N.A.
	Wyoming	Warsaw Glen	Unusual flora, mountain saxifrage	N.A.
	Cayuga & Others	Cayuga Lake	Geologic features	42,496
	Cayuga & Seneca	Montezuma Marsh	Marsh Habitat	6,175
	Cayuga	Wood Mill, Town of Scipio	Jeffersonia diphylla	N.A.
	Madison	Chittenango Falls State Pk.	Unusual flora	123
	Oneida	Fish Creek, Taberg	Unusual flora, Canadian primrose & butterwort	N.A.
	"	Rome Sand Plains	Geologic feature	3,200
	Onondaga	Cicero Swamp	Unusual flora & fauna	3,720
	"	Clark Reservation	Unusual flora, Hart's tongue fern	228
	Oswego	Barrier Beaches	Geologic features	5 miles of shoreline
	"	Salmon River Falls, Orwell	Unusual flora, Canadian primrose & mountain saxifrage	N.A.
	"	Deer Creek Marsh	Waterfowl & fur bearers-shore wetland	

Table 3 (con't)

NATURAL AREAS IN NEW YORK

Planning Subarea	County	Name of Area	Importance	Acres
5.2 (Cont.)	Oswego	Three Mile Bay GMA	Fishery, waterfowl & furbearers includes Toad Harbor and Big Bay Creek	
	"	Butterfly Marsh	Lake shore marshes waterfowl and furbearers	
	"	Teal Marsh	Waterfowl & furbearers - Oswego Harbor	
	Cayuga	Hollands Island Game Management Area		
	Oswego	Peter Scott Swamp	Waterfowl & furbearer value	
	Entire Area	Finger Lakes	Unique group of fresh water lakes & marshes	
	Oswego & Wayne	Lake Ontario Barrier Beaches	Reaches & associated wetlands	
	Herkimer	Moose River Plains	Wilderness area - headwaters of Moose R.	
	"	Fulton Chain of Lakes		
	"	Mud Pond, Jordanville	Unusual flora, rare orchids	N.A.
	"	Mountain Peaks 2000'+		
	Wayne	Duck Lake Bogs, Town of Conquest	Unusual flora	N.A.
	"	Mud Pond, Town of Zurich	Unusual flora	N.A.
	"	Zurich Bog	Unusual flora	100
	"	Chimney Bluffs	Geological features	3 miles of shoreline
	Seneca	Junius Ponds	Unusual flora & fauna, rare orchids, muhlenberg's turtle	N.A.

Table 3 (con't)

NATURAL AREAS IN NEW YORK

Planning Subarea	County	Name of Area	Importance	Acres
5.2 (cont.)	Seneca & Others	Seneca Lake	Geologic features	42,688
	Tomkins	Fall Creek Gorge, Ithaca	Unusual flora	N.A.
	"	Taughannock Falls State Pk.	Unusual flora and geological features	794
	"	Connecticut Hill G.M.A.	Unusual flora, coal sink	11,610
	Yates	Parish Glen, Naples	Heron rookery	N.A.
5.2 & 5.3	Herkimer & St. Lawrence	Adirondack Forest Preserve	Wilderness, forest & mountains	
5.3	Jefferson	Perch River GMA	Waterfowl, fishery & furbearer values	
	"	Lakeview Marsh Note: Include Ponds & Beach		
	"	Dexter Marsh	Lakeshore marsh -waterfowl & furbearers	
	"	Eldorado Shores Note: Include Black Pond		
	"	Indian River & Lakes	River & lake system-waterfowl, fishery & furbearers	
	"	Little Galloup Island		
	"	Goose Bay	Waterfowl significance	
	"	Wilson Hill Game Management Area		
	"	High Bluffs Area	Harbor & point - waterfowl & fishery values	
	"	NYS Great Lakes Fisheries Res. Center	Sport & commercial fish Res. Center	

Table 3 (con't)

NATURAL AREAS IN NEW YORK

Planning Subarea	County	Name of Area	Importance	Acres
5.3 (Cont.)	Jefferson	Lake Ontario Off-shore islands	High value for fishing, shorebirds, & diving ducks	
	"	1,000 Island Complex	Geologic features	N.A.
	"	Galoo Island	Herring Gull rookery	5,000
	"	Limestone Bluffs, Henderson Harbor	Geologic features	2 miles of shoreline
	St. Lawrence	Iroquois Dam on St. Lawrence River		N.A.
	"	Massena Power Dam & Seaway Project		N.A.
	"	Chippewa Bay	Waterfowl & fishery values	
	"	Mountain Peaks 2000'+		
	"	Upper & Lower Lakes	Waterfowl & fishery values	
	"	Fish Creek GMA (includes Black Lake)	Waterfowl, fishery & furbearers	
All four Areas		Erie Barge Canal	Connecting waterway between Great Lakes and Hudson River system. Recreation, fishing, hunting, allows interchange of aquatic life.	
		Tug Hill Plateau		

Table 4. Hunting and Fishing License Sales in All of New York State 1940-1964.

Type of license	1940	1962-63	1963-64
Combination (fish & hunt)			
Resident	248,314	212,845	206,917
Non-resident	5,820	xxx	xxx
A Total	254,134	212,845	206,917
Hunting (small game)			
Resident	159,334	277,925	267,515
Non-resident	xxx	25,489	24,328
B Total	159,334	303,414	291,843
Big game			
Resident	157,286	449,979	463,697
Non-resident	940	17,105	16,672
C Total	158,226	467,084	480,369
Special Deer			
Resident	xxx	xxx	xxx
Non-resident	xxx	xxx	xxx
Total	xxx	xxx	xxx
Special Archery			
Resident	xxx	14,651	13,923
Non-resident	xxx	602	588
Total	xxx	15,253	14,511
Trapping			
Resident	8,400	8,050	8,818
Non-resident	3	15	17
Total	8,403	8,065	8,835
Fishing			
Resident	189,185	466,357	469,106
Non-resident	6,905	36,886	38,287
D Total	196,090	503,243	507,393
"Transient" fishing			
3-day	2,584	xxx	xxx
E 6-day	xxx	11,828	11,250

From New York Department of Conservation

Table 5. Game Harvest in the New York Portion of the Lake Ontario Basin by Species 1960-1968

Species	Planning Sub-area Totals				
	4.4	5.1	5.2	5.3	Total
Pheasant 1963-64	83,000	64,000	86,000	11,000	244,000
Woodcock 1960-61	10,000	7,000	15,000	2,000	37,000
Snowshoe R. 1961-62	No Season	No Season	29,000	76,000	105,000
Cottontail R. 1963-64	107,000	93,000	270,000	47,000	51 7,000
Ducks - Coots 1967-68	19,000	23,000	66,000	29,000	137,000
Geese - Brants 1964-65	600	3,000	8,000	1,500	13,100
Ruffed Grouse 1967-68	33,000	27,000	60,000	32,000	152,000
Squirrel 1965-66	98,000	74,000	159,000	26,000	377,000
Deer	6,000	8,000	11,000	8,000	33,000

Latest figures available by species

From Great Lakes Basin Framework Study
Appendix 17

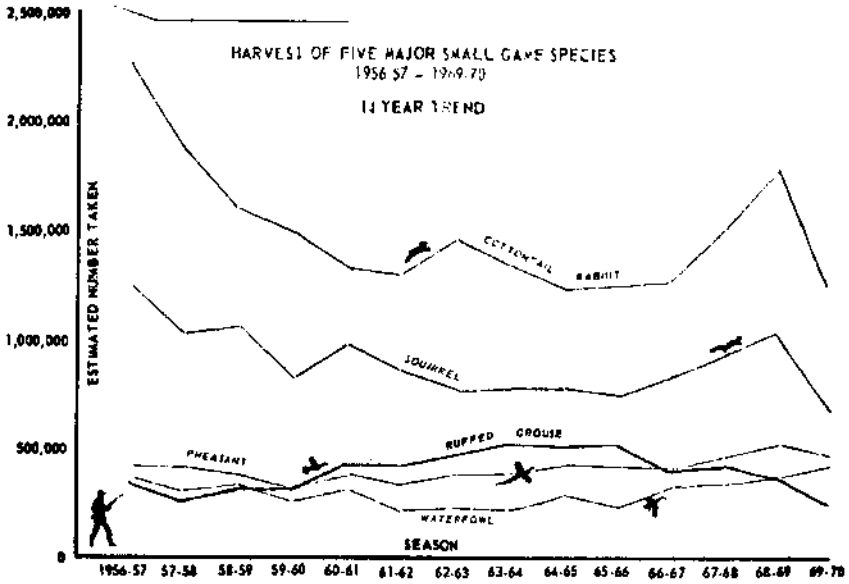
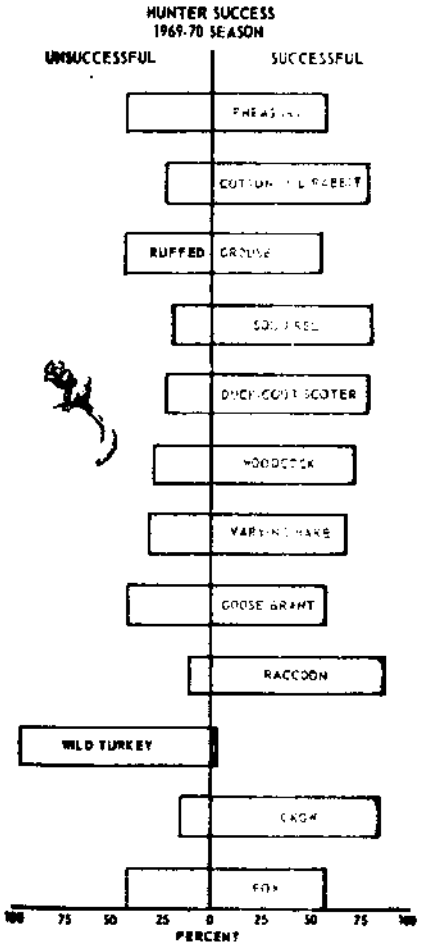


Figure 4. Small Game Hunting Success and Harvest for New York State



From Maguire (1971)

Table 6. Total Hunters in the U.S. Portion of the Lake Ontario Basin (with a selected portion of subregion 4.4) 1970-2020

Plan Subarea	Hunters (x 1000) 1970 1/	1980 2/	2000 2/	2020 2/
4.4	153.3	190.1	206.9	218.0
5.1	74.9	92.7	109.1	125.3
5.2	153.5	179.6	211.9	246.7
5.3	35.6	41.3	44.0	47.8

1/ includes resident and non-resident licensed hunters and unlicensed hunters

2/ includes resident and non-resident licensed hunters, unlicensed hunters and latent demand hunters.

From Great Lakes Basin Framework Study
Appendix 17

Table 7. Resident Licenses Hunters (1000's) in the U.S. Lake Ontario Basin (with a selected portion of region 4.4) 1970-2020

Plan Subarea	1970	1980	2000	2020
4.4	129.1	132.1	143.8	151.5
5.1	64.1	66.1	77.8	89.4
5.2	131.3	133.5	157.6	183.4
5.3	30.2	31.4	33.5	36.3

From Great Lakes Basin Framework Study
Appendix 17

Table 8. Total Fur Catch in the New York Portion of the Lake Ontario Basin 1965

New York - 50% of State Total

	Catch	Ave. Value	Total Value
Fisher	181	12.00	$ 2,172
Otter	159	24.00	3,816
	340		$ 5,988

From Great Lakes Basin Framework Study
Appendix 17

Table 9. Extinct, Rare, and Endangered Vertebrates in Ontario

From Simkin(1970)

EXTINCT

Mammals

(None)

Birds

Passenger Pigeon	*Ectopistes migratorius*	Last flock in Ontario, 1884. Last specimen taken in wild, 1900. Last living individual known died in captivity in Cincinnati Zoological Gardens, Cincinnati, Ohio, September 1, 1914.
Wild Turkey	*Meleagris gallopavo*	Last specimen taken in Ontario, 1904. A few local attempts to re-introduce but with limited chance of success due to lack of availability of suitable habitat. Elsewhere in North America, many huntable populations remain.

Reptiles

Timber Rattlesnake	*Crotalus horridus horridus*	Last one positively identified was captured at Niagara Glen in 1941.

Amphibians

(None)

Fishes

Blue Pickerel	*Stizostedion vitreum glaucum*	Last reported from Lake Erie in 1966. This fish is probably extinct.
Paddlefish	*Polyodon spathula*	Not reported from Ontario waters for 50 years. Extinct in the Great Lakes. Still found in Mississippi River.

Table 9 (con't)

RARE OR ENDANGERED

Mammals		
Puma	*Felis concolour*	Never very common. Infrequent and as yet unauthenticated reports from North Bay, White River and Kenora areas. Last Ontario specimen prior to 1908.
Birds		
Peregrine Falcon	*Falco peregrinus*	No known eyries in Ontario.
Bald Eagle	*Haliaeetus leucocephalus*	Still a common nesting species in northwestern Ontario but with reduced nesting success and high levels of insecticide residues in eggs.
Osprey	*Pandion haliaetus*	Similar status to bald eagle.
Prairie Chicken	*Tympanuchus cupido*	No pure prairie chickens remain. Many hybrids (sharp-tailed grouse x prairie chicken) occur on Manitoulin Island.
Reptiles—Snakes		
Black Rat Snake	*Elaphe obsoleta obsoleta*	Numbers drastically decreased especially in Lake Erie area.
Eastern Fox Snake	*Elaphe vulpina gloydi*	General decrease in numbers. People often kill this snake as the young bear a superficial resemblance to the massasauga rattler.
Blue Racer	*Coluber constrictor foxi*	Never common and now almost wiped out in its only Canadian locality (extreme southwestern Ontario) largely due to loss of habitat.
Queen snake	*Regina septemvittata*	Never common (southwestern Ontario).
Lake Erie Water Snake	*Natrix sipedon insularum*	Found only on a few islands in Lake Erie where its numbers are declining.
Butler's Garter Snake	*Thamnophis butleri*	Never very common.
Eastern Hognose Snake	*Heterodon platyrhinos*	Endangered mainly because of kills by people who believe it is a puff adder.
Eastern Massasauga Rattlesnake	*Sistrurus catenatus catenatus*	Still fairly abundant in some areas. People cannot be persuaded to let a venomous snake live especially in vacation localities.
Reptiles—Turtles		
Spotted Turtle	*Clemmys guttata*	Becoming increasingly rare due to loss of marshy areas, pollution of waters, and collecting for the pet trade.
Eastern Spiny Softshell Turtle	*Trionyx spinifer spinifer*	Never very common and declining rapidly. Because of their aggressive nature, they are often killed.

Table 9 (con't)

Amphibians

Blanchard's Cricket Frog	*Acris crepitans blanchardi*	A very limited range, recorded only from Point Pelee and Pelee Island.
Fowler's Toad	*Bufo woodhousei fowleri*	Still relatively common in some areas, but it has disappeared from portions of its former range.
Small-mouthed Salamander	*Ambystoma texanum*	Found only on Pelee Island. Declining in numbers.

Note–Amphibians are smaller and more secretive in their ways than reptiles, for the most part, so in some cases their present status may not be as well known. In general, amphibians are in considerable danger because most are aquatic in the early stages of life, and the pollution of waters and the draining and filling of swamps and marshes is taking a toll.

Fishes

Lake Sturgeon	*Acipenser fulvescens*	Once abundant throughout large lake and river systems in Ontario. Considered rare in many parts of its range.
Spotted Gar	*Lepistosteus oculatus*	Found only in extreme southern Ontario, the northern edge of its range.
Atlantic Salmon	*Salmo salar*	Extinct in Ontario except for a small introduced population in Trout Lake near North Bay. Still common in parts of Quebec and north Atlantic coast areas.
Arctic Char	*Salvelinus alpinus*	Rare in Ontario. It has been found naturally occurring only in the Severn and Winisk Rivers in the Hudson Bay watershed. It has been introduced to lakes in Algonquin Park. It is common elsewhere in its range.
Deepwater Cisco	*Coregonus johannae*	Once abundant in Lakes Michigan and Huron. Last reported in 1951. Possibly extinct.
Blackfin Cisco	*Coregonus nigripinnis*	Once abundant in Lakes Ontario, Michigan and Huron. Last reported in 1955. Possibly extinct.
Grass Pickerel	*Esox vermiculatus*	At northern edge of its range, this fish occurs in Ontario only in extreme south. Occurs in United States from Lakes Erie and Ontario to eastern Texas.
Lake Chubsucker	*Erimyzon sucetta*	Common in the United States but reported only from Lake St. Clair and Lake Erie in Ontario.
Bigmouth Buffalo	*Ictiobus cyprinellus*	Widely distributed in United States but only one specimen reported from Long Point Bay in Lake Erie, an 18-pound fish taken by a commercial fisherman.

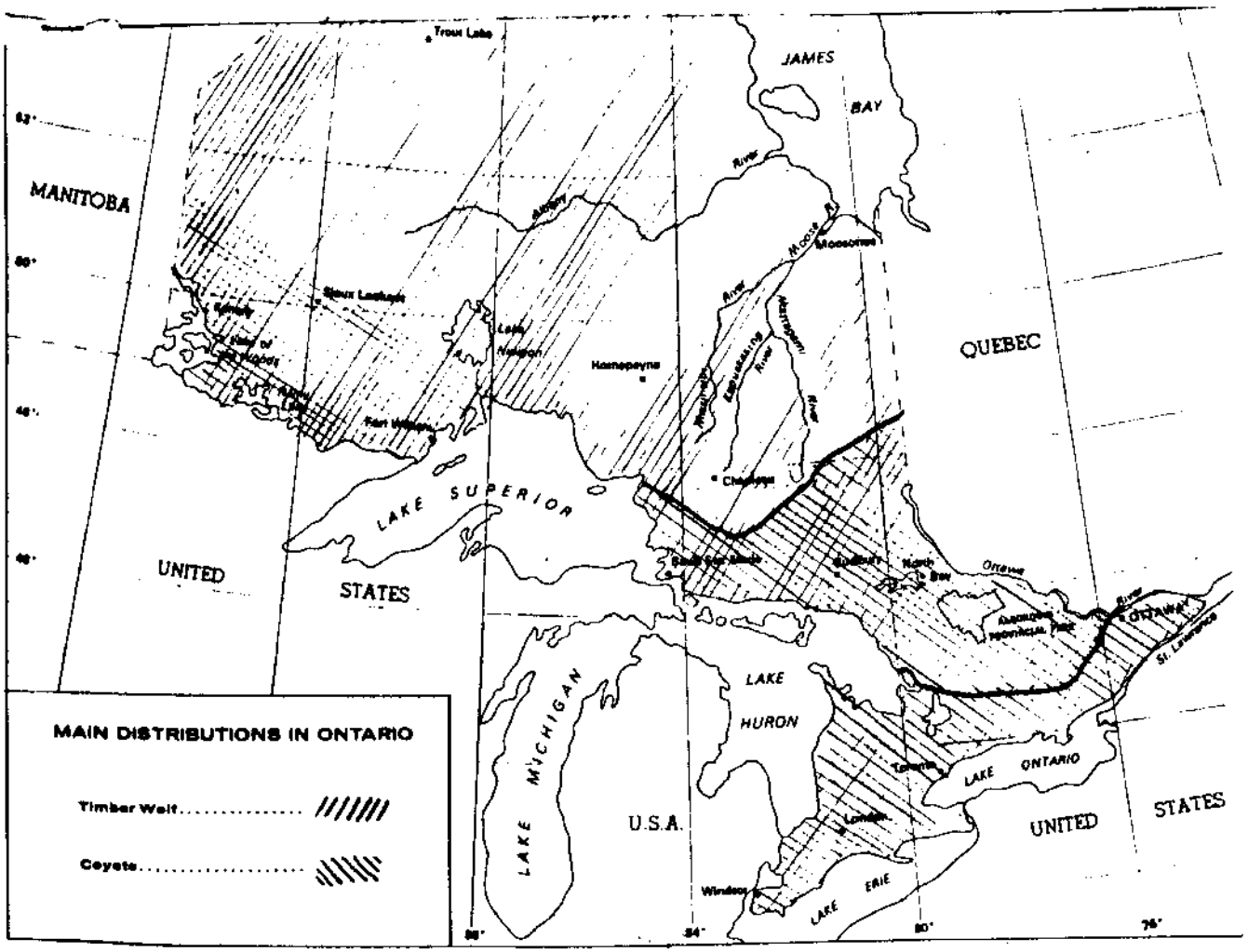
Table 9 (cont.)

Golden Redhorse	*Moxostoma erythrurum*	Widely distributed in the United States, but found only in Catfish Creek, a tributary of Lake Erie, in Lake St. Clair, and in southern Lake Huron drainages in Ontario.
Black Redhorse	*Moxostoma duquesnei*	Widely distributed in medium sized clear rivers in the United States. Found only in Catfish Creek and a tributary of the Grand River, both tributaries to Lake Erie. Has not been seen for 30 years.
Gravel Chub	*Hybopsis x-punctata*	A rare species in Ontario, reported only from the Thames River. Less rare in the United States.
Silver Chub	*Hybopsis storeriana*	A rare fish in Ontario. Occasionally captured in Lake Erie but not seen for 10 years. Less rare in the United States.
Pugnose Minnow	*Opsopoeodus emiliae*	A rare fish in Ontario. Reported twice from Lake St. Clair and once from the Detroit River. Less rare in the United States.
Redside Dace	*Clinostomus elongatus*	Found only in clear streams flowing into western Lake Ontario. Less rare in the United States.
Pugnose Shiner	*Notropis anogenus*	A rare fish in Canada. Occurs in clear, weedy ponds on Point Pelee, and the Upper St. Lawrence River. Less rare in the United States.
Cutlips	*Exoglossum maxillingua*	A rare fish in Ontario, found in fast flowing streams near Ivy Lea, Leeds County.
Brindled Madtom	*Noturus miurus*	A rare species in Canada, reported only from the Sydenham River and two streams flowing into central Lake Erie in Ontario. Less rare in the United States.
Longear Sunfish	*Lepomis megalotis*	Reported only from Lake Erie, Lake St. Clair, southern Georgian Bay and Rainy River regions. Occurs sparsely. Common in the United States.
Green Sunfish	*Lepomis cyanellus*	Rare in Canada. Found in Thames watershed, Perth County and some small lakes in Bruce County. Also reported from Quetico Park. Less rare in the United States.
Channel Darter	*Percina copelandi*	At the northern edge of its range in Ontario. Reported only from sand and gravel beaches near Port Burwell, Erieau, and Point Pelee in Lake Erie, and

Table 9 (cont.)

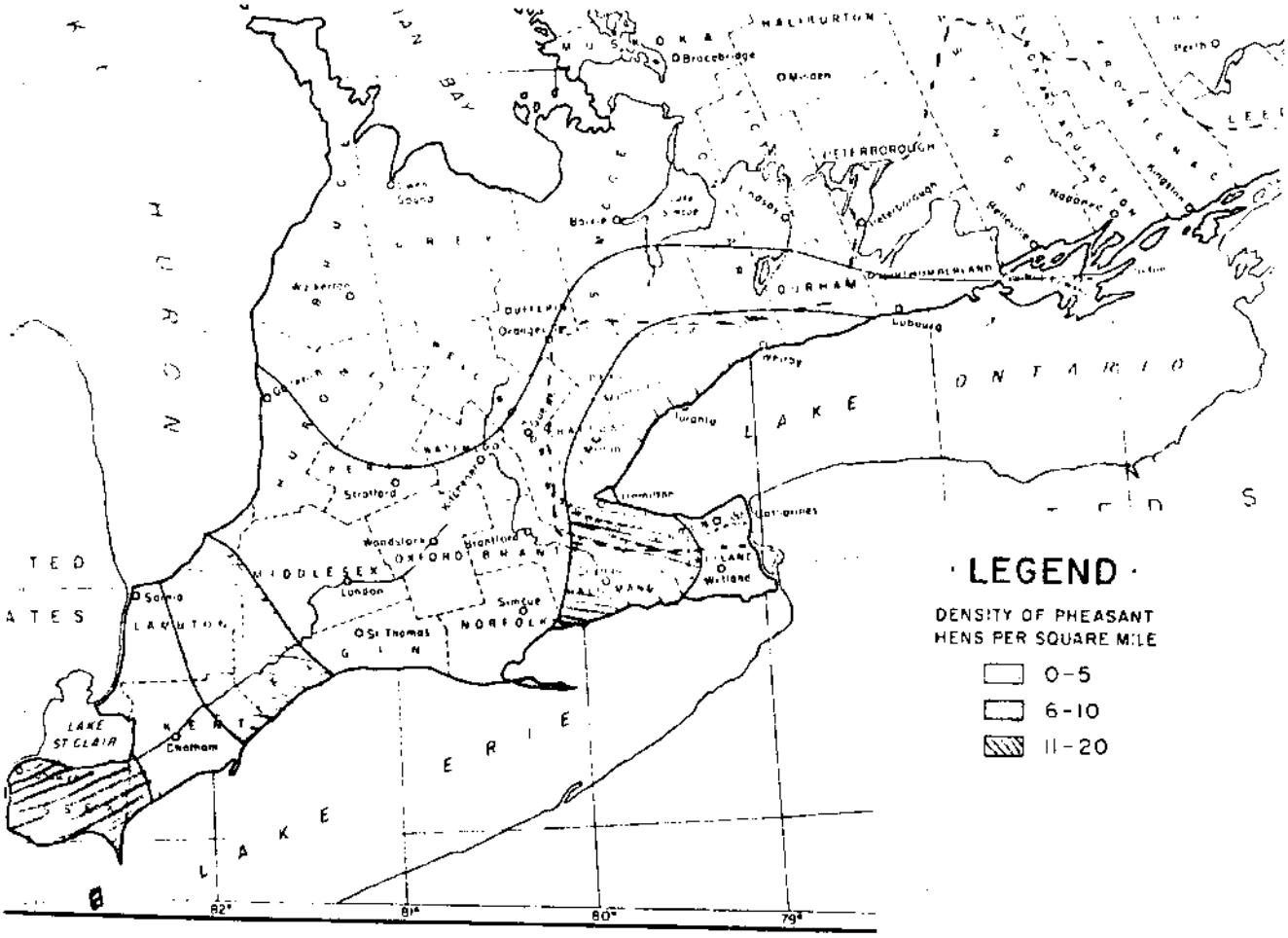
Greenside Darter	*Etheostoma blennioides*	Found only in Lake St. Clair drainage. Less rare in the United States.
Least Darter	*Etheostoma microperca*	In Ontario reported only from western Lake Ontario, Lake Erie and Lake St. Clair. Less rare in United States.
Deepwater Sculpin	*Myoxocephalus quadricornis*	Occurred in deep waters of all the Great Lakes, Lake Nipigon and a few inland glacial lakes. It has virtually disappeared from Lake Ontario in recent years, where it was once abundant.

Figure 5. Distribution of Wolves and Coyotes in Ontario



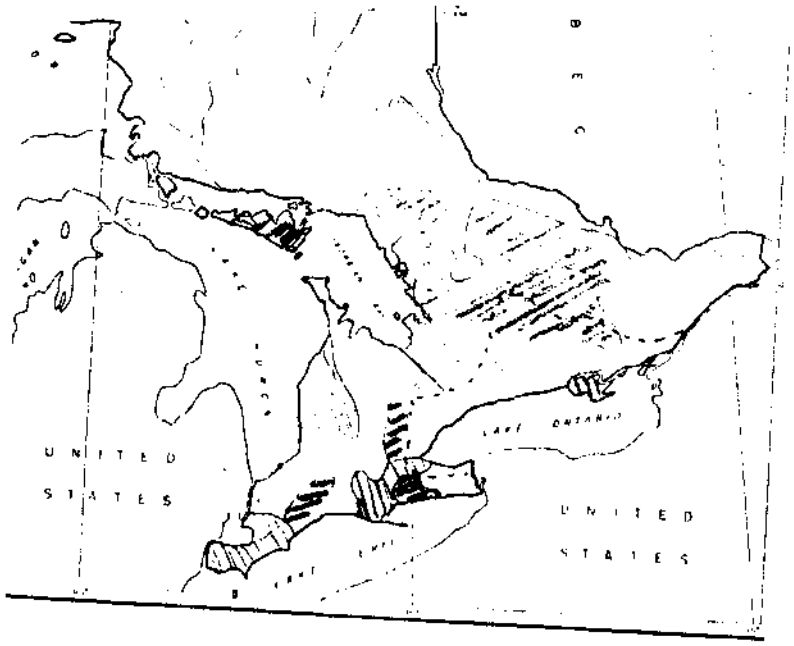
From Ontario Department of Lands and Forests (1963)

Figure 6. Distribution of Pheasants in Southern Ontario



From Ontario Department of Lands and Forests (1963)

Figure 7. Distribution of Deer in Southern Ontario



·LEGEND·

ESTIMATED DENSITY OF DEER

- ABUNDANT
- COMMON
- RARE
- ABSENT

From Department of Lands and Forests (1963)

Table 10

AVERAGE DRESSED WEIGHTS OF DEER
in Ontario and Neighbouring States
(Numbers Weighed in Brackets)

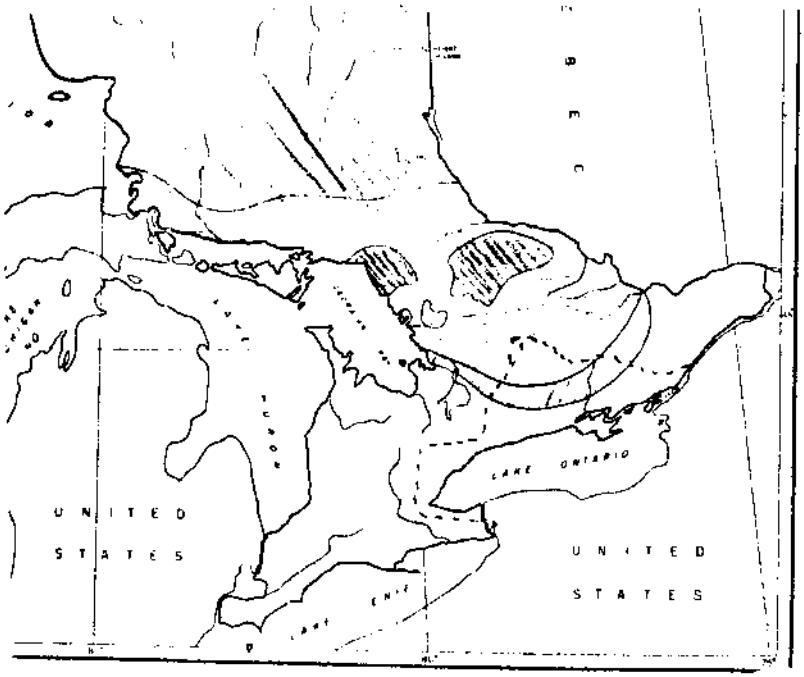
PLACE	*ADULT BUCKS	*ADULT DOES	BUCK FAWNS	DOE FAWNS
Minnesota (Several Areas Combined)	162.1 (1759)	125.6 (1925)	75.3 (715)	70.3 (702)
Northwestern Ontario	167.9 (173)	117.9 (198)	69.6 (88)	66.6 (86)
Southeastern Ontario	146.0 (361)	105.6 (401)	66.7 (137)	63.2 (147)
New Hampshire	131.0 (1984)	107.5 (1456)	64.1 (645)	58.4 (568)
Wisconsin				
Good Range	110.5 (1052)	101.9 (1203)	59.9 (411)	55.7 (383)
Poor Range	98.8 (2324)	97.2 (2151)	56.7 (649)	53.4 (637)

**Yearlings included with adults.*

Note: Northwestern Ontario deer are among the largest, but even southeastern Ontario deer are larger than most from neighbouring areas.

From Comming and Walden (1970)

Figure 8. Distribution of Moose in Southern Ontario



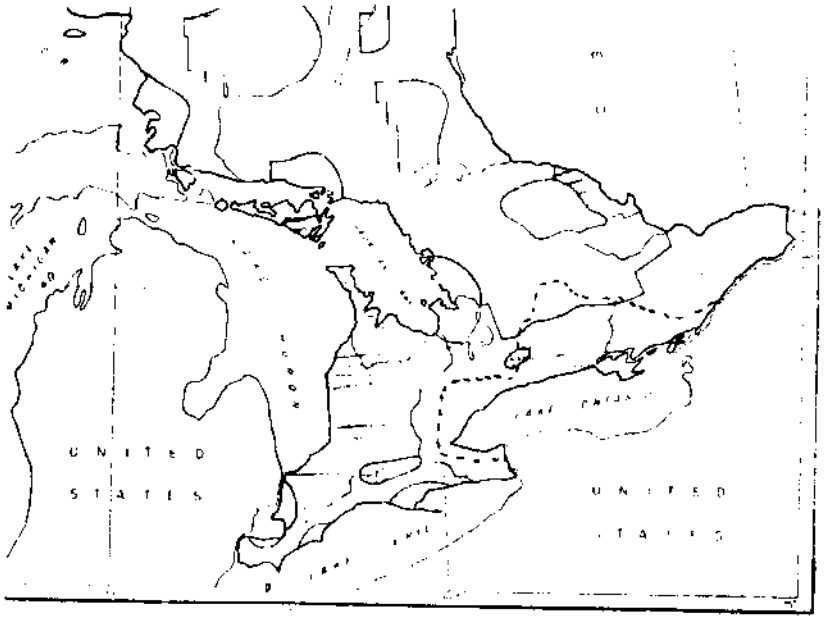
LEGEND

ESTIMATED DENSITY OF MOOSE

- ABUNDANT
- COMMON
- RARE
- ABSENT

From Ontario Department of Lands and Forests(1963)

Figure 9. Trapper Distribution in Southern Ontario



LEGEND

REGISTERED TRAPLINES LICENCED TO PATRICIA INDIAN BAND AND FAMILY GROUPS

REGISTERED TRAPLINES LICENCED TO PREDOMINANTLY INDIAN PEOPLE

NOT REGISTERED AS TRAPLINE AREAS AND LICENCED TO RESIDENT AND FARMER TRAPPERS

REGISTERED TRAPLINE AREAS LICENCED TO PREDOMINANTLY NON-INDIAN TRAPPERS

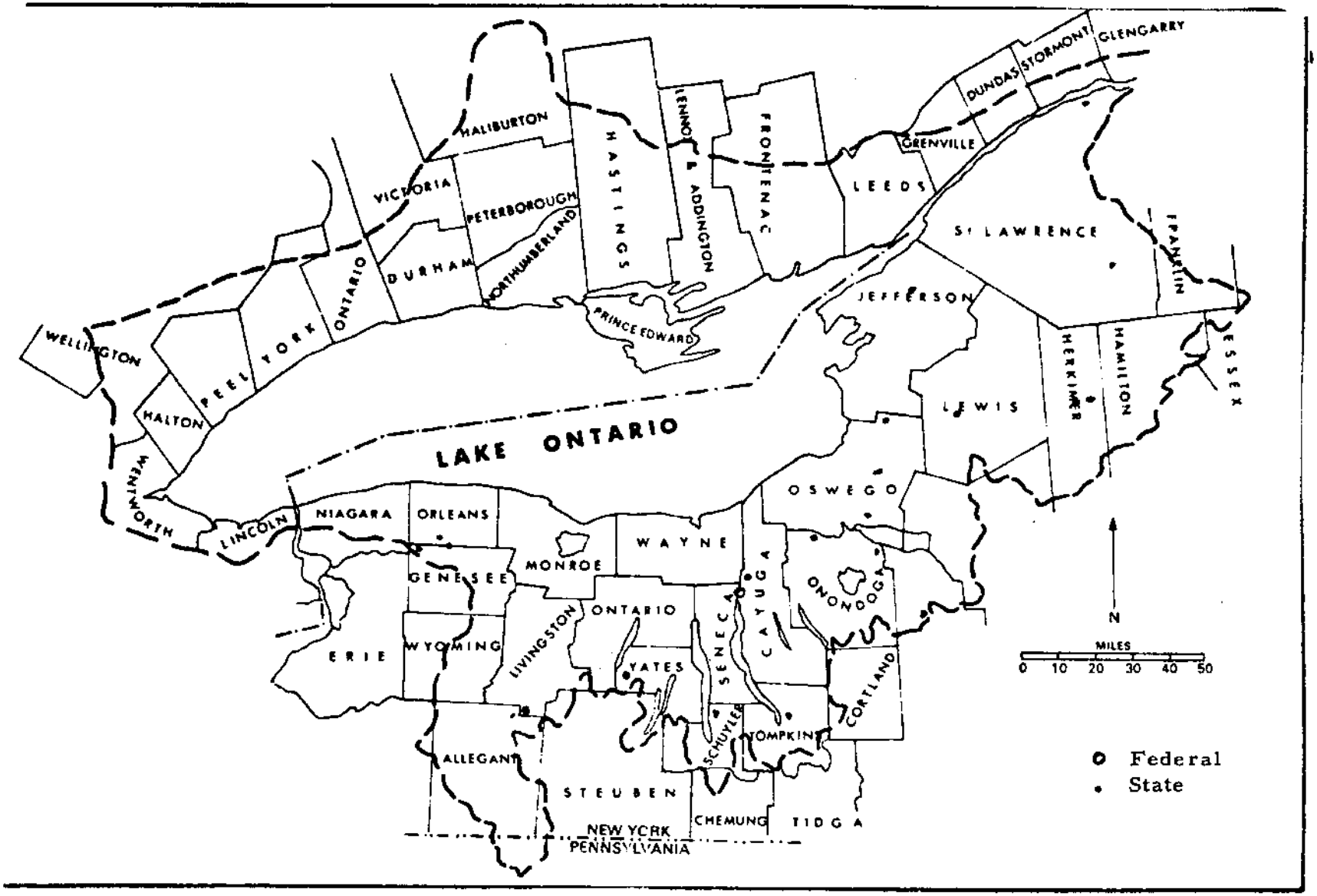
From Ontario Department of Lands and Forests(1963)

Table 11. License Sales in the Province of Ontario 1969-1970

	Resident	Non-Resident
Deer	97,659	6,572
Moose	49,867	15,103
Bear	1,359	9,448
Total Big Game	148,885	31,123
Small Game	360,192	12,900
Migratory Waterfowl	123,891	9,081

From Ontario Department of Lands and Forests(1971)

Figure 10. Federal and State Game Management Areas in the Southern Portion of the Lake Ontario Basin



From New York Department of Conservation Map

Table 12. Public Lands Open to Hunting in the New York Portion of the Lake Ontario Basin (excluding part of region 4.4) mid 1960's (acres).

New York	national forest	public hunting	State forest	others
4.4	--	9,100	42,100	61,000 (State Park)
5.1	--	16,700	44,700	16,600 (State Park)
5.2	13,800	53,900	129,200	
5.3	--	36,900	81,400	8,200 (State Park)
TOTAL	13,800	116,600	297,400	85,800

From Great Lakes Basin Framework Study
Appendix 17

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Fishery

APPENDIX A

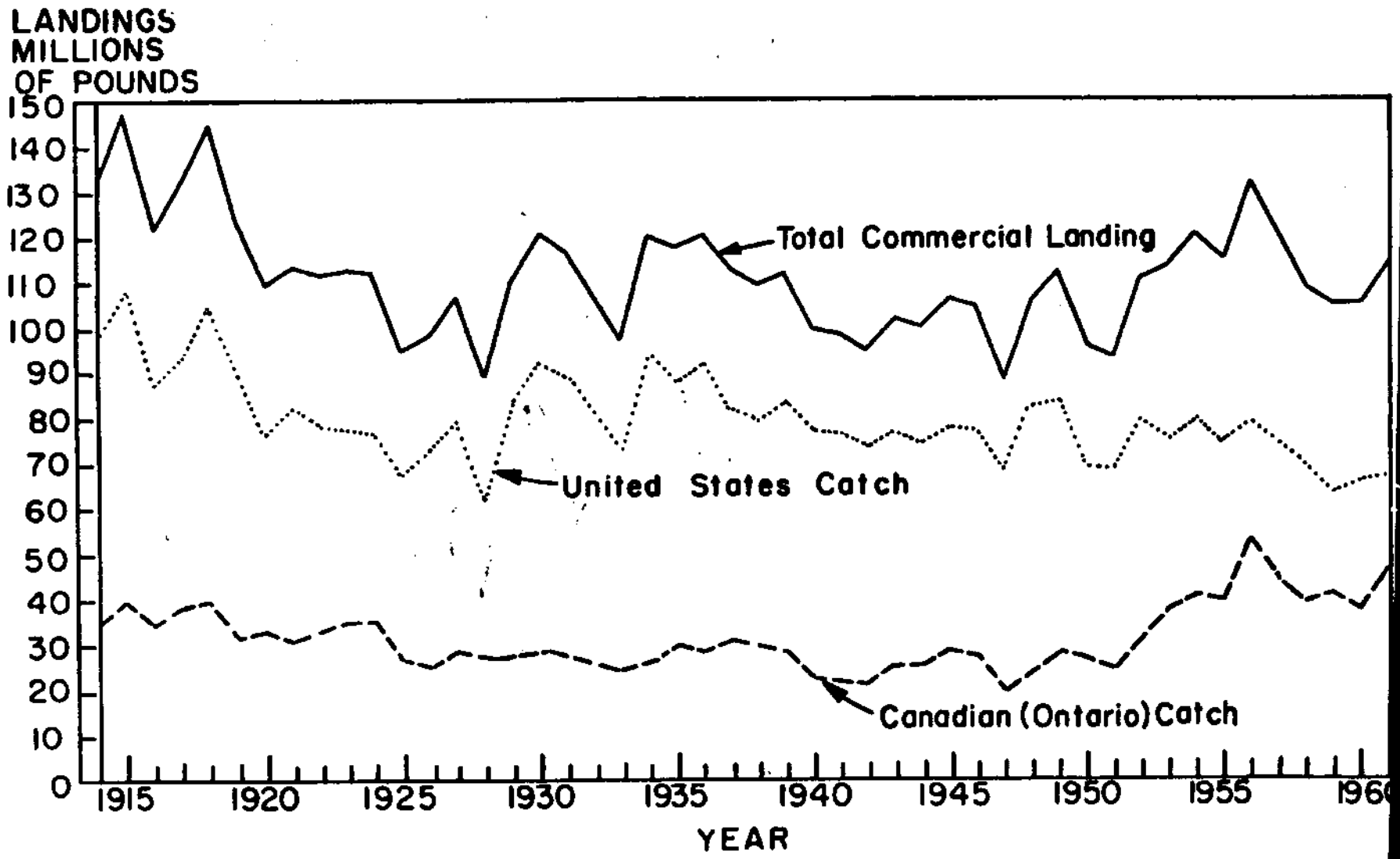
Catch Statistics for Lake Ontario

From Great Lakes Fishery Commission

and

Christie (1971 ms)

Annual landings by Canada and the United States of all species from the Great Lakes, 1914 – 1961.



From Anderson (1969)

Figure 1

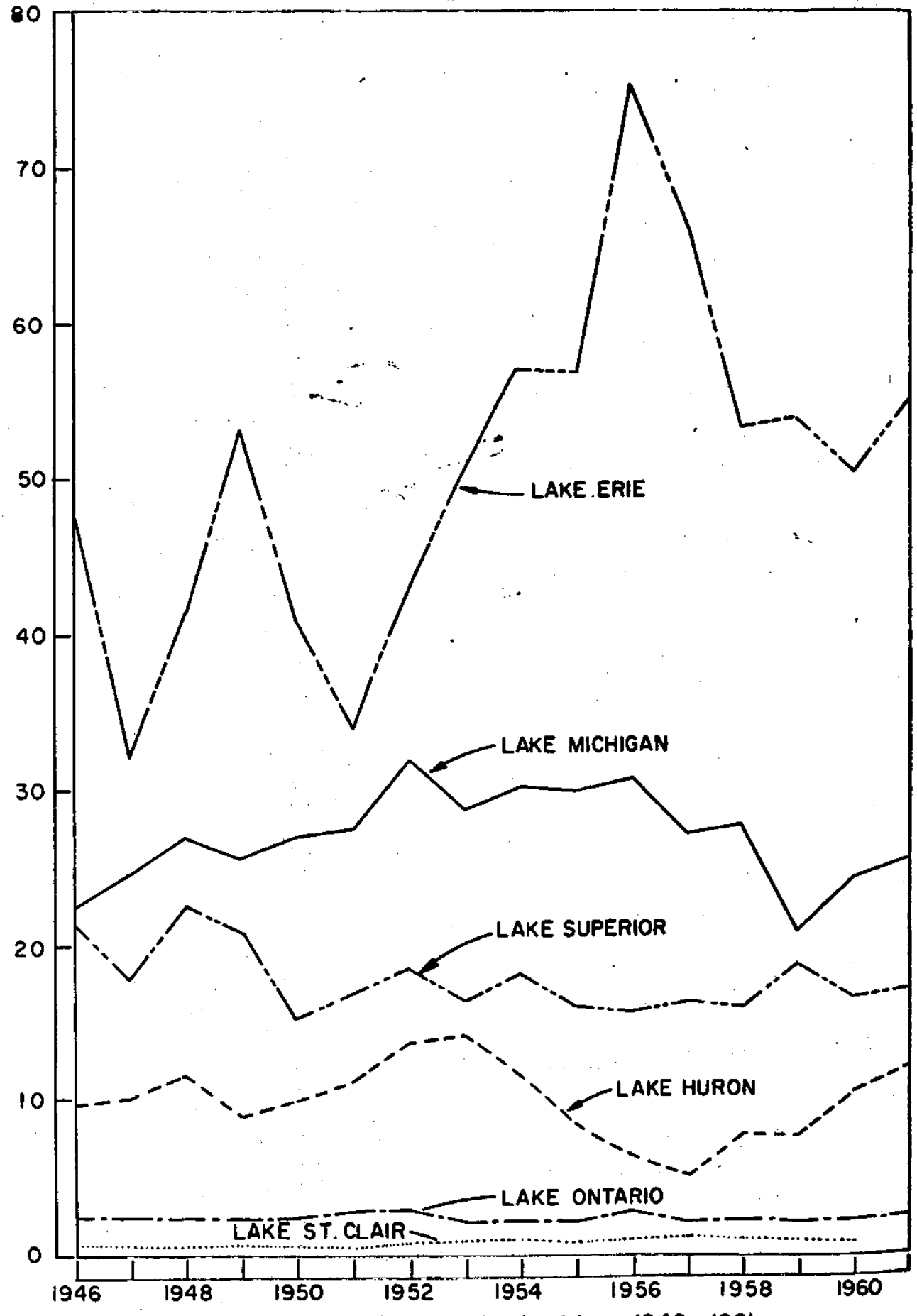


Fig.2 Great Lakes landings of all species by lake, 1946 – 1961.

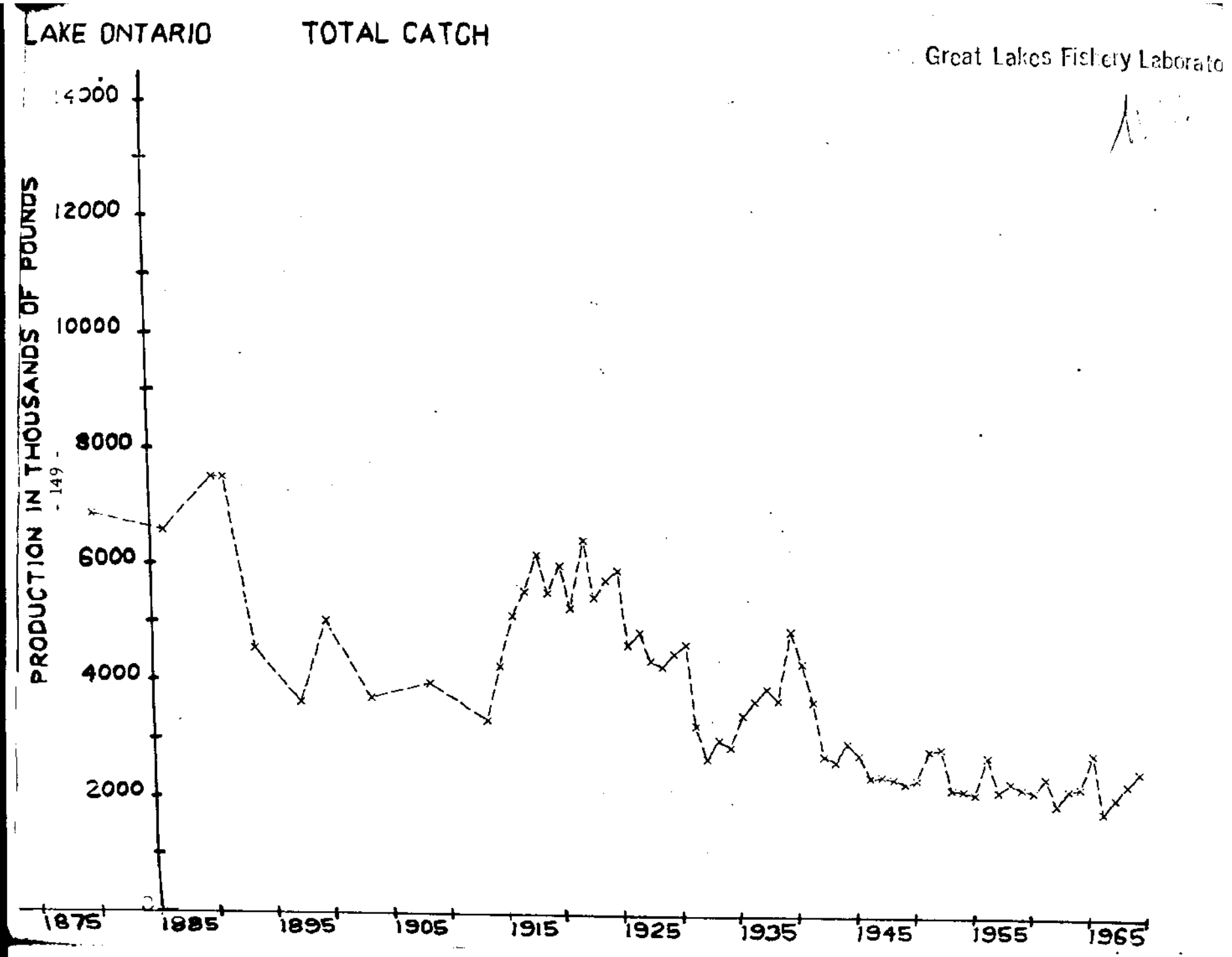
From Anderson (1969)

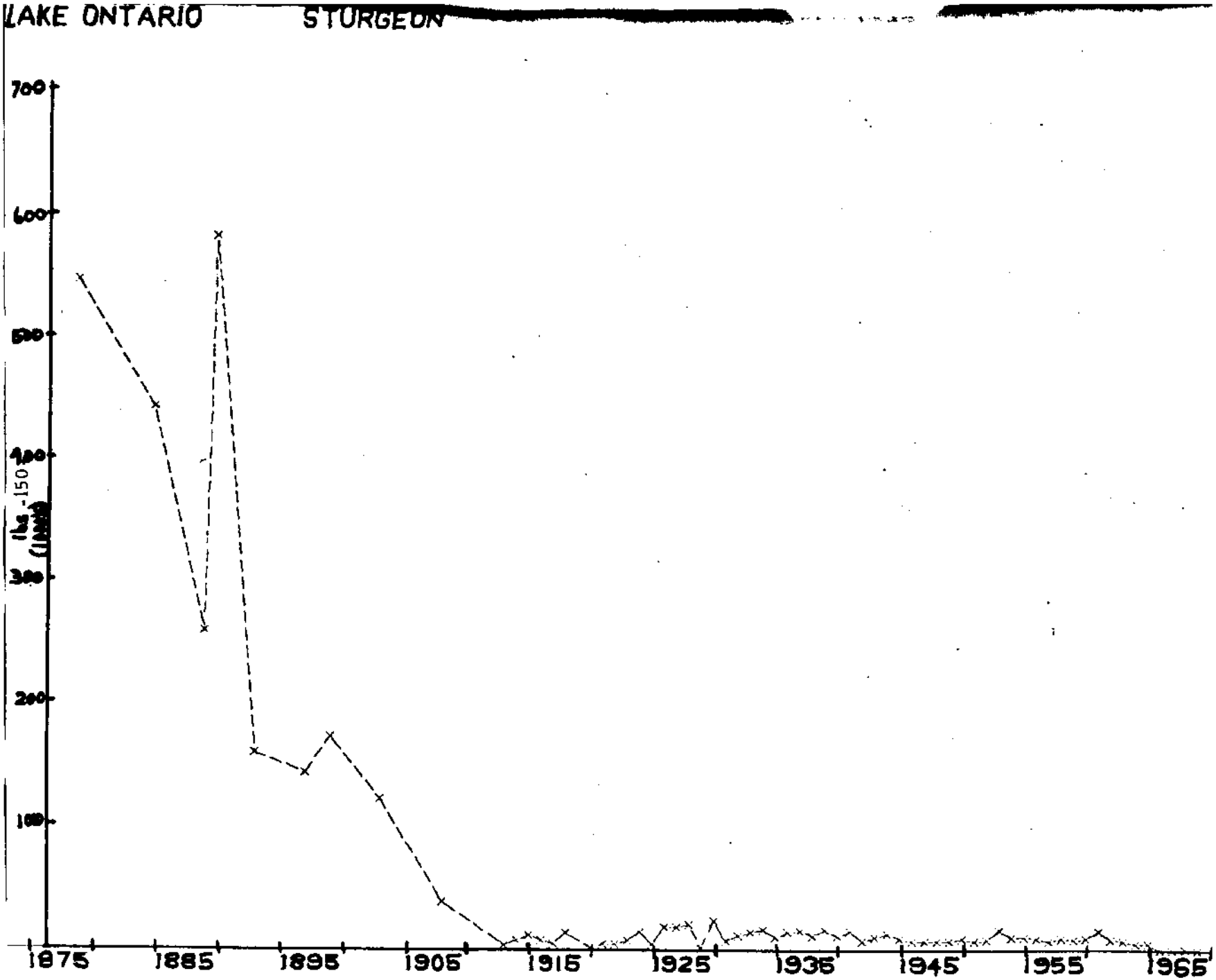
LAKE ONTARIO

Table 21. — Production (thousands of pounds) of ALL SPECIES in Lake Ontario.

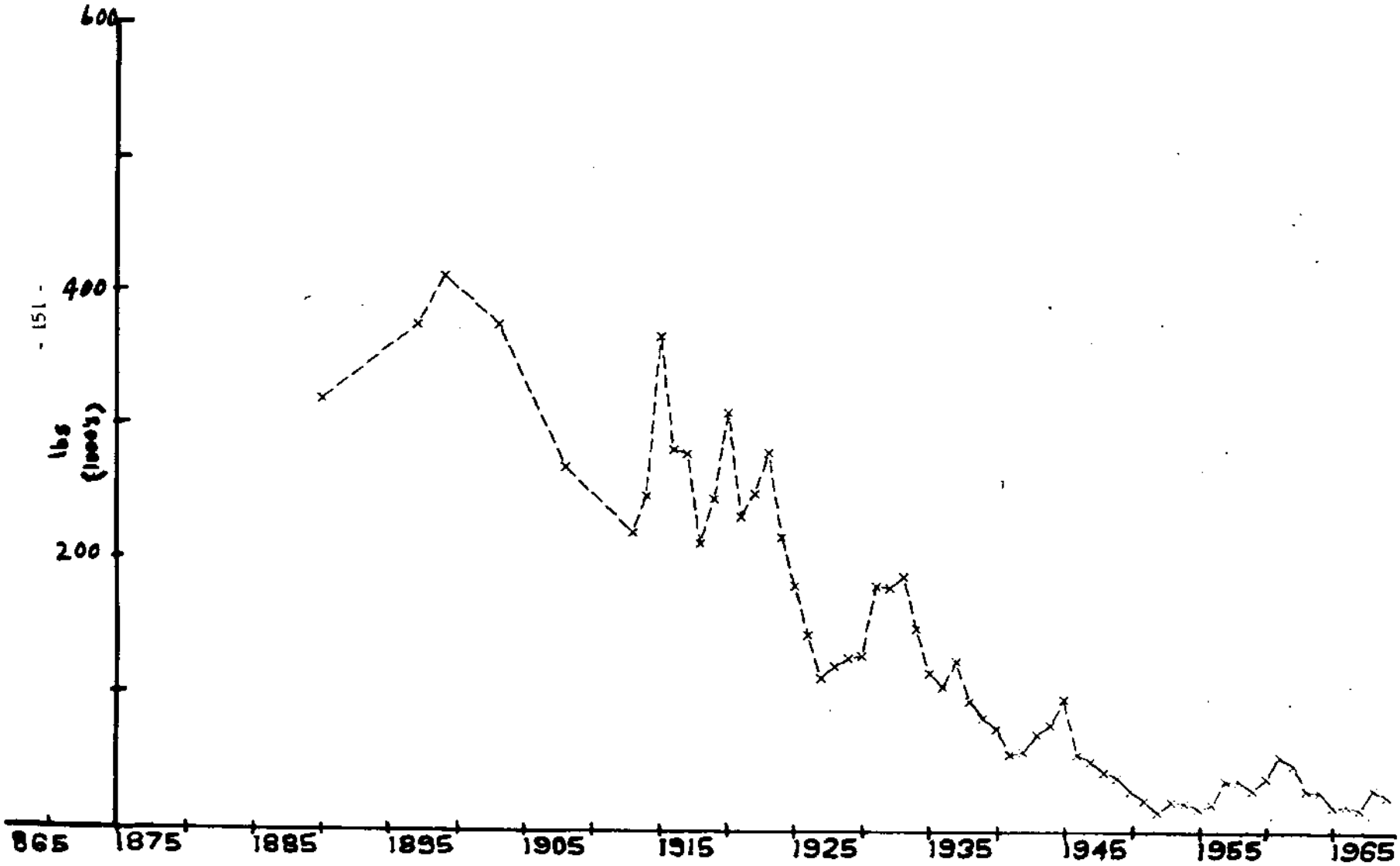
Year	U. S. New York	Canada Ontario	Total	Year	U. S. New York	Canada Ontario	Total
1869	-	1,579	-	1919	544	5,504	6,048
1870	-	1,547	-	1920	330	4,988	5,318
1871	-	1,631	-	1921	1,914	4,577	6,491
1872	-	1,757	-	1922	965	4,532	5,497
1873	-	2,331	-	1923	841	4,947	5,788
1874	-	1,563	-	1924	993	4,975	5,968
1875	-	2,088	-	1925	446	4,250	4,696
1876	-	2,310	-	1926	788	4,118	4,906
1877	-	2,409	-	1927	698	3,731	4,429
1878	-	2,607	-	1928	854	3,477	4,330
1879	3,640	3,238	6,878	1929	948	3,810	4,557
1880	-	2,866	-	1930	682	4,021	4,703
1881	-	3,001	-	1931	442	2,869	3,310
1882	-	2,719	-	1932	521	2,232	2,754
1883	-	2,168	-	1933	527	2,551	3,078
1884	-	3,581	-	1934	717	2,231	2,948
1885	2,398	4,204	8,602	1935	770	2,723	3,493
1886	-	2,306	-	1936	601	3,126	3,727
1887	-	3,626	-	1937	618	3,330	3,948
1888	-	4,684	-	1938	690	3,068	3,758
1889	2,692	4,833	7,525	1939	1,456	3,495	4,951
1890	3,446	4,089	7,535	1940	1,359	3,022	4,381
1891	-	4,383	-	1941	597	3,126	3,724
1892	-	4,038	-	1942	325	2,488	2,813
1893	928	3,670	4,598	1943	395	2,311	2,707
1894	-	2,592	-	1944	400	2,637	3,037
1895	-	3,444	-	1945	492	2,338	2,830
1896	-	4,219	-	1946	384	2,059	2,442
1897	921	2,753	3,674	1947	464	2,002	2,465
1898	-	3,426	-	1948	386	2,045	2,431
1899	2,310	2,761	5,071	1949	351	2,006	2,357
1900	-	2,666	-	1950	189	2,219	2,408
1901	-	3,975	-	1951	498	2,410	2,908
1902	-	4,130	-	1952	668	2,281	2,950
1903	1,073	2,682	3,754	1953	196	2,059	2,256
1904	-	2,299	-	1954	311	1,914	2,225
1905	-	2,663	-	1955	233	1,943	2,176
1906	-	2,433	-	1956	180	2,627	2,807
1907	-	2,609	-	1957	206	1,997	2,203
1908	817	3,199	4,016	1958	263	2,098	2,361
1909	-	4,236	-	1959	226	2,051	2,277
1910	-	3,557	-	1960	258	1,958	2,216
1911	-	3,697	-				
1912	-	3,366	-				
1913	208	3,153	3,361				
1914	296	4,024	4,320				
1915	384	4,787	5,170				
1916	344	5,253	5,597				
1917	628	5,600	6,228				
1918	464	5,103	5,567				

From Baldwin and Saafeld (1962)

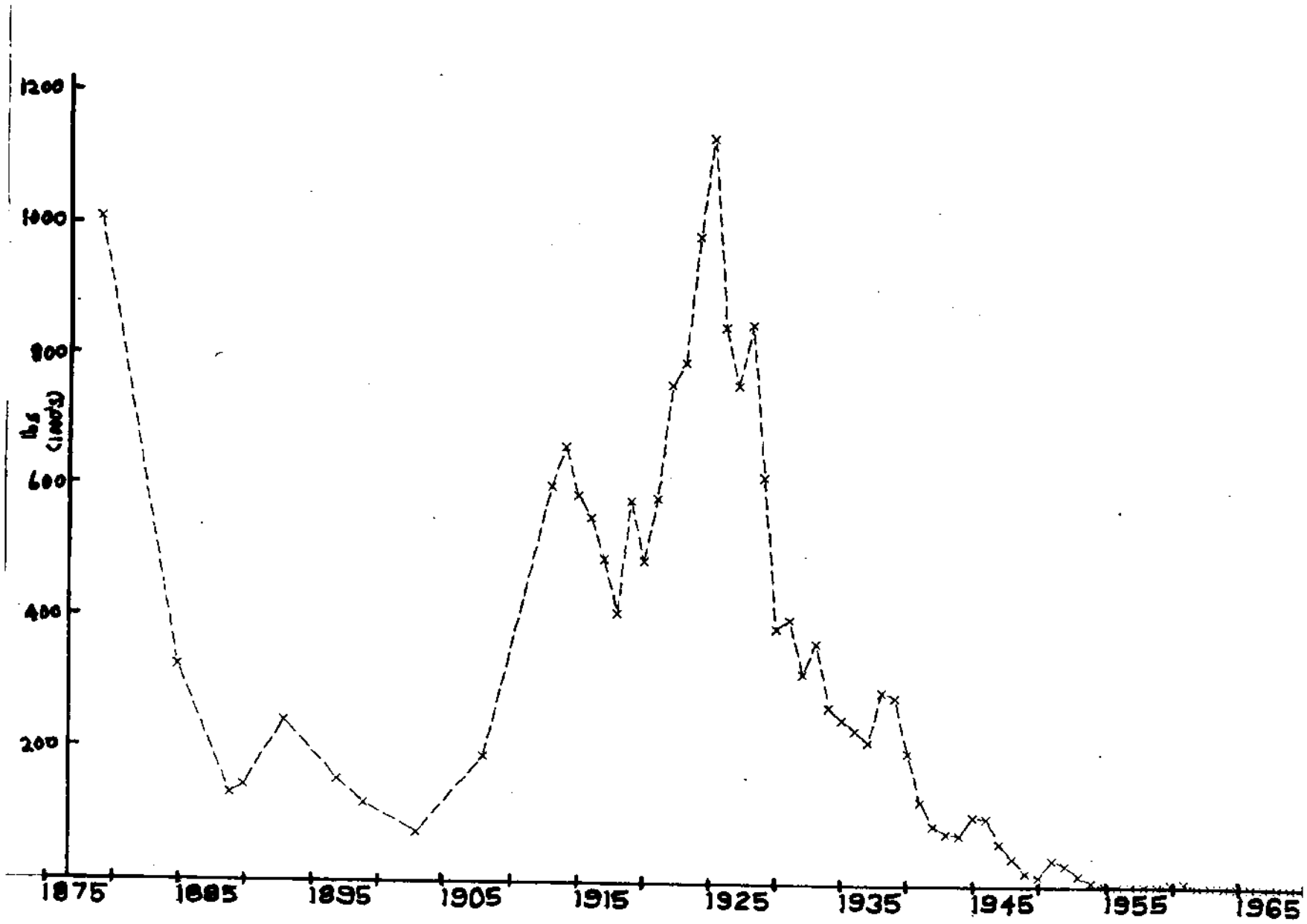

LAKE ONTARIO TOTAL CATCH
Great Lakes Fishery Laborato
PRODUCTION IN THOUSANDS OF POUNDS
14000
12000
10000
8000
6000
4000
2000
0
1875
1885
1895
1905
1915
1925
1935
1945
1955
1965


LAKE ONTARIO
STURGEON
700
600
500
400
300
200
100
1875
1885
1895
1905
1915
1925
1935
1945
1955
1965

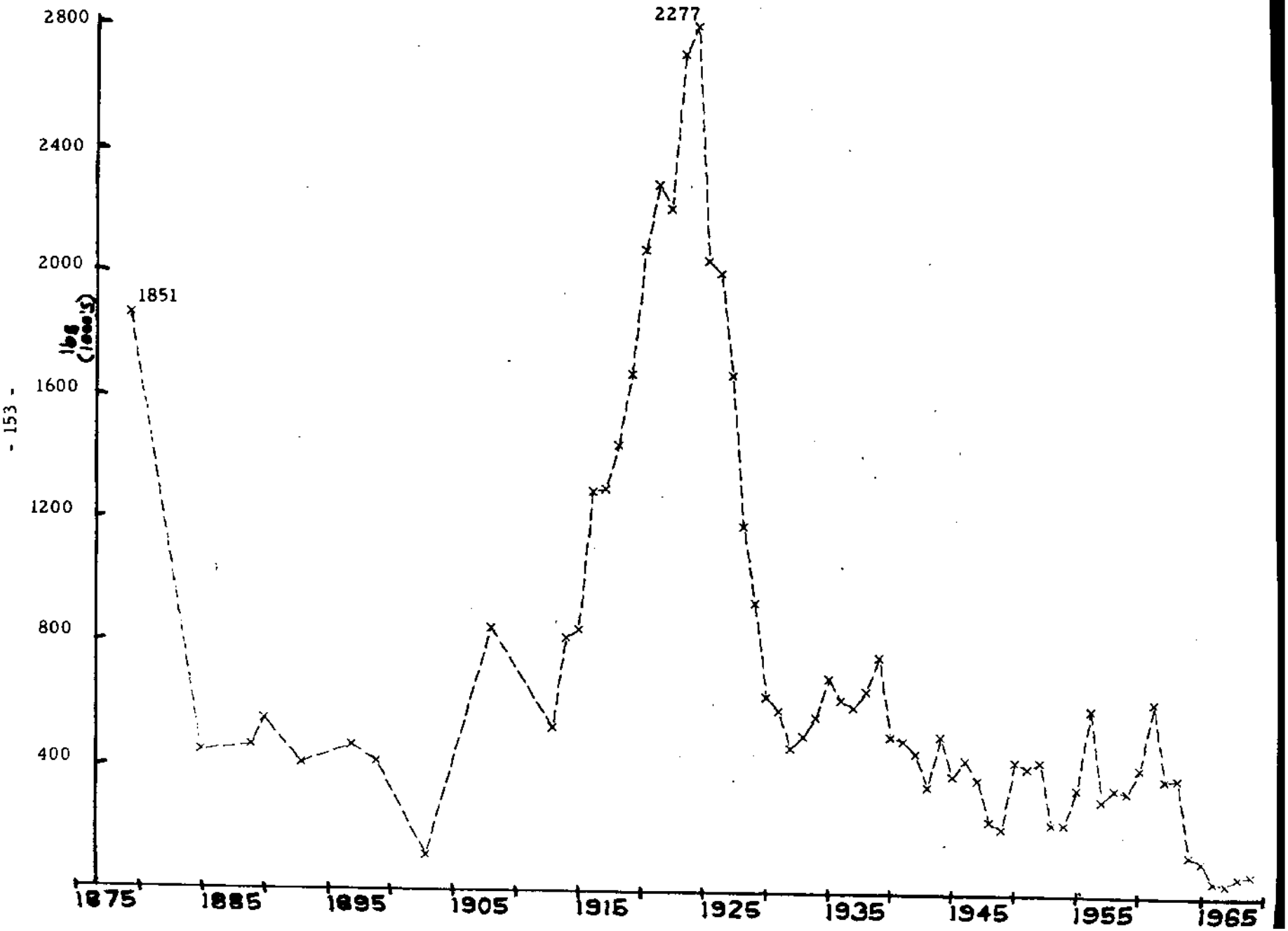
LAKE ONTARIO NORTHERN PIKE



LAKE ONTARIO LAKE TROUT



LAKE ONTARIO WHITEFISH



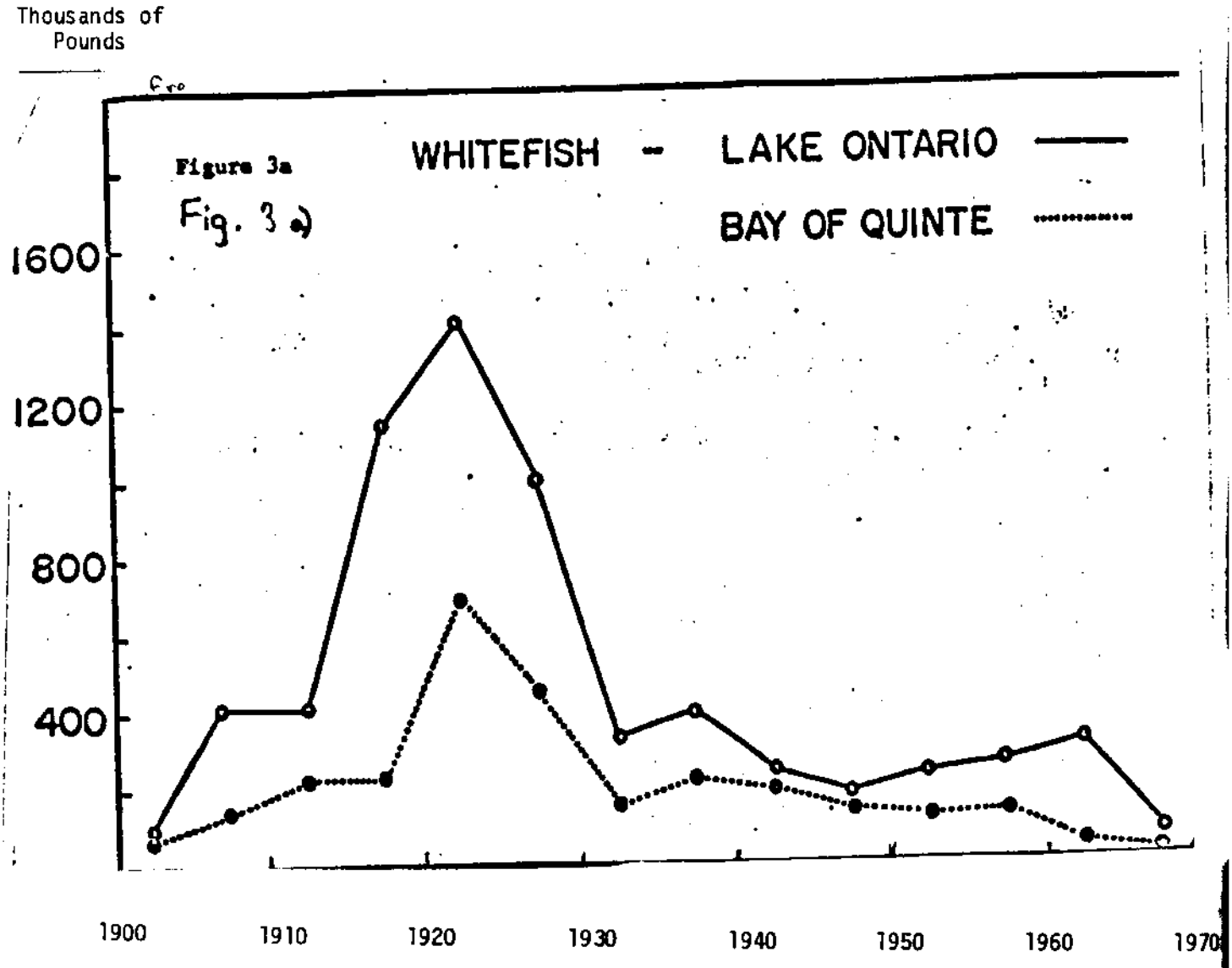
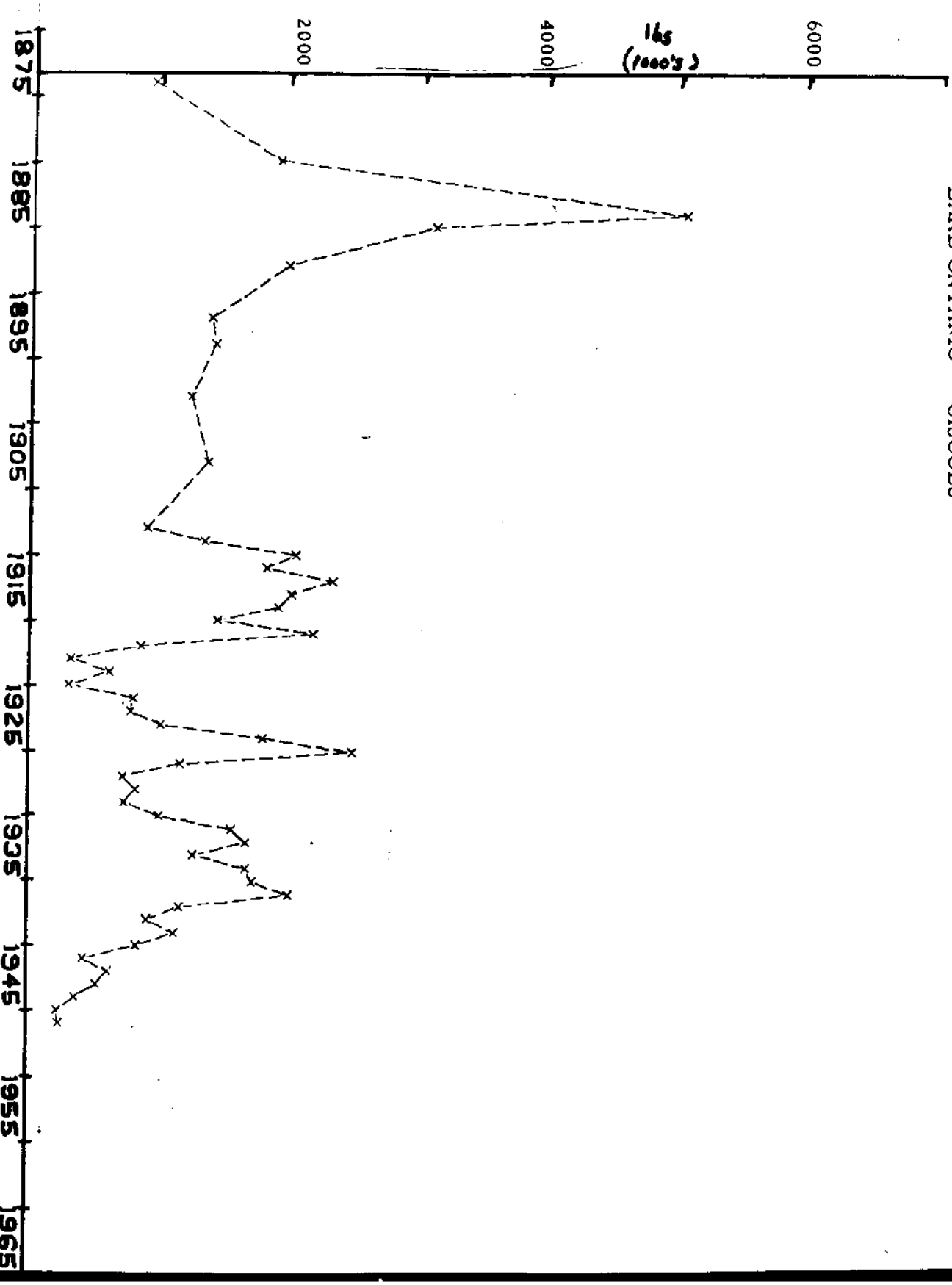


Figure 3a

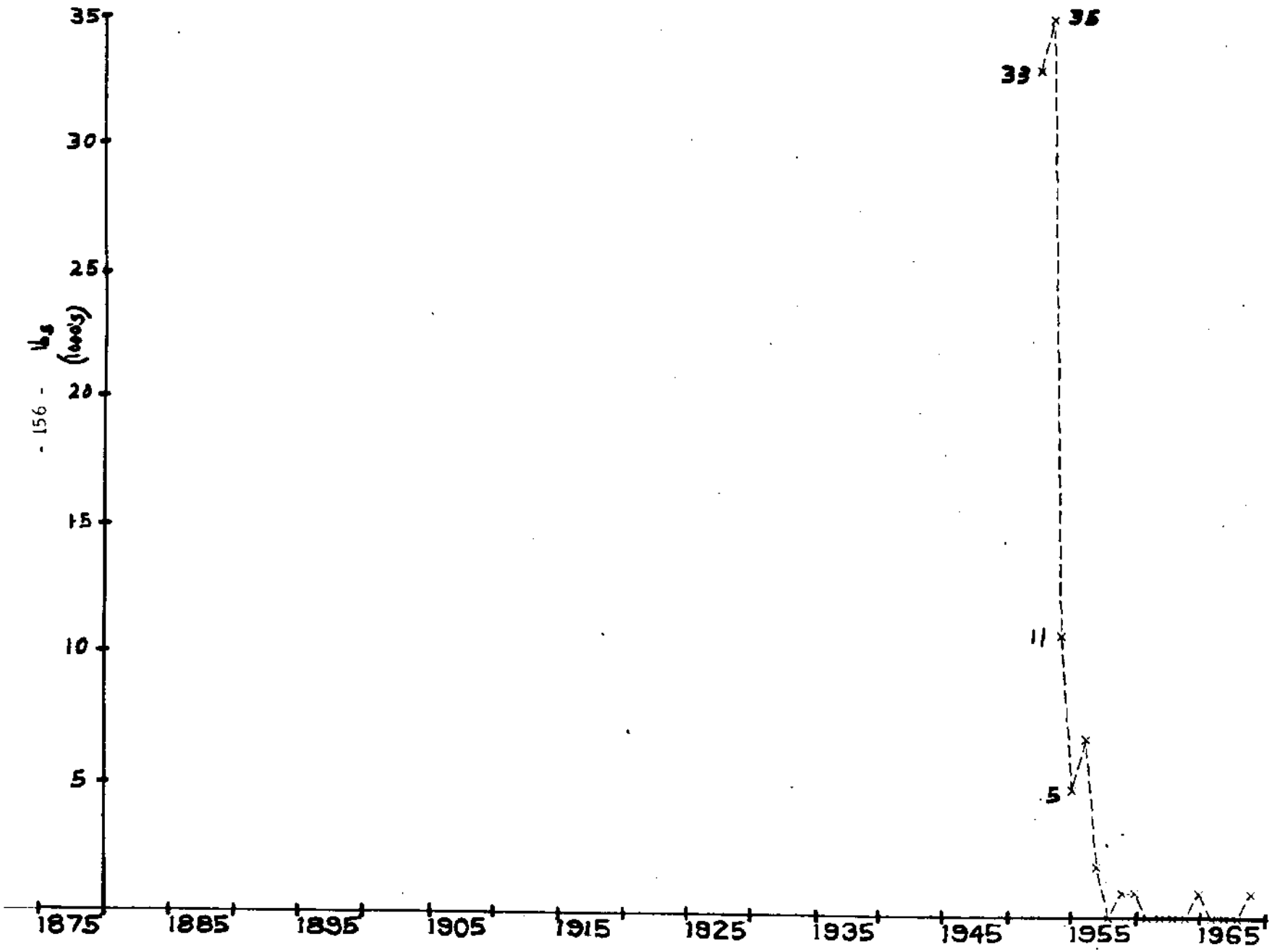
Fig. 3 a)

From Christie (1971 ms)

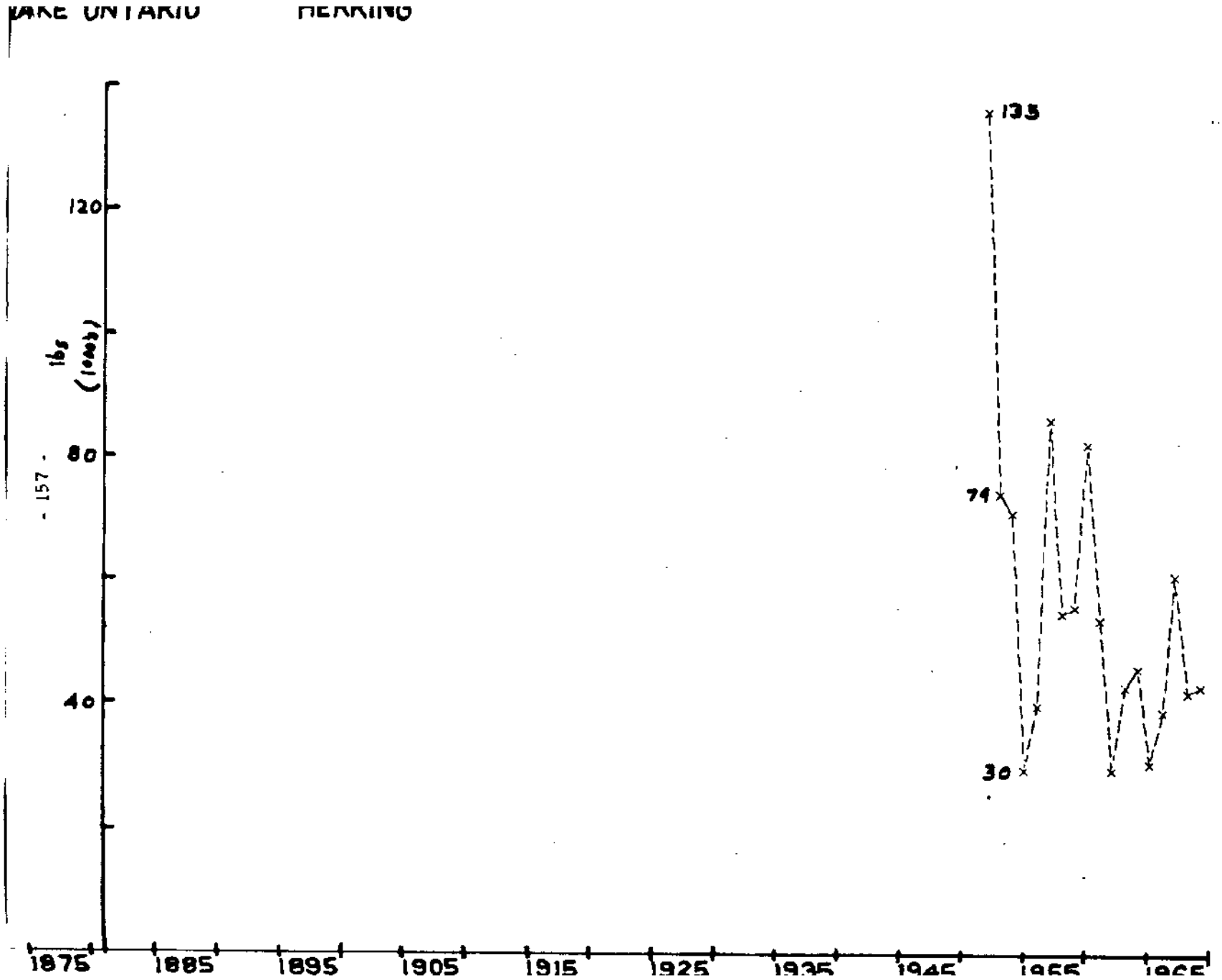


LAKE ONTARIO CISCOES

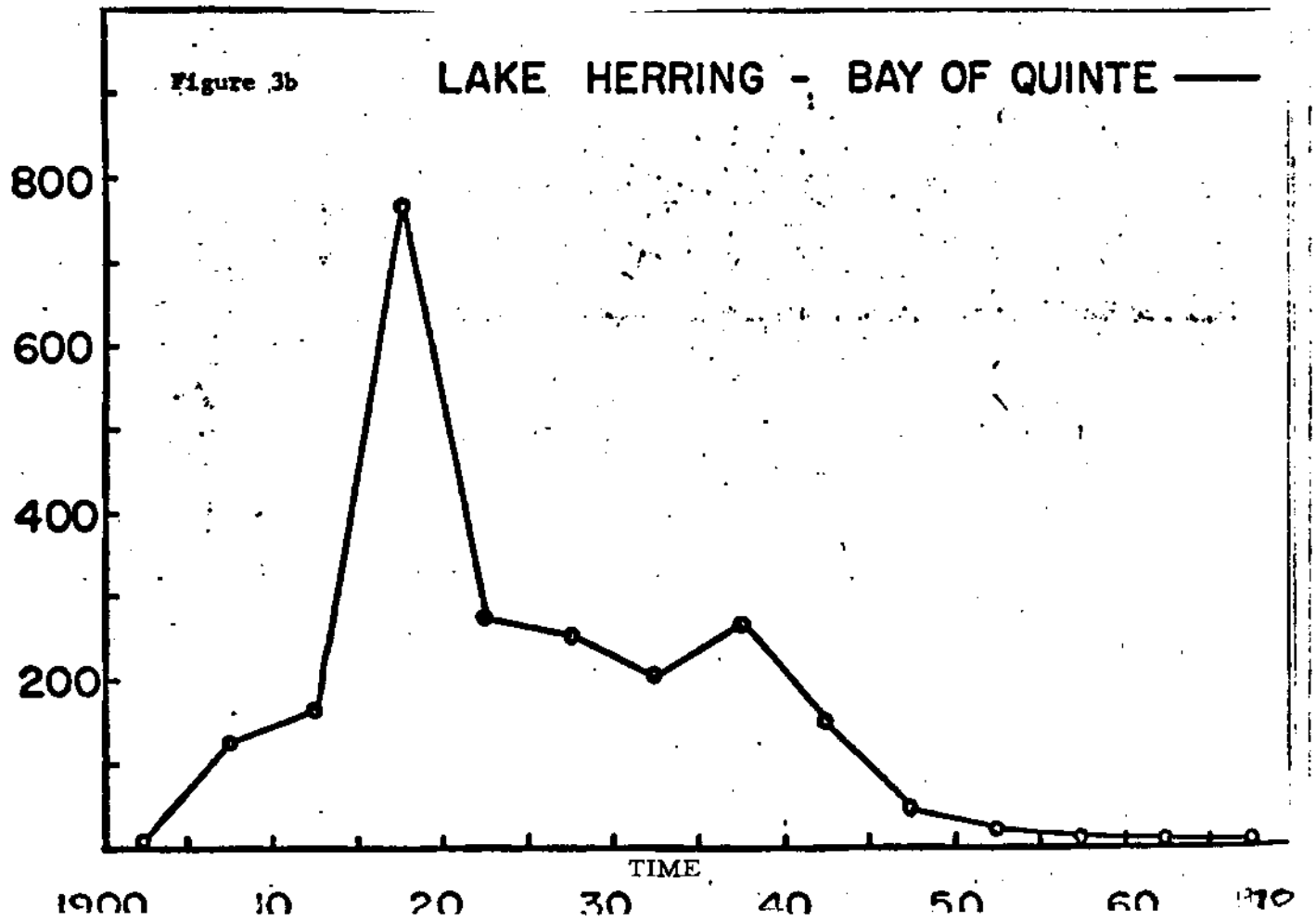
LAKE ONTARIO CHUBS



LAKE ONTARIO HERRING

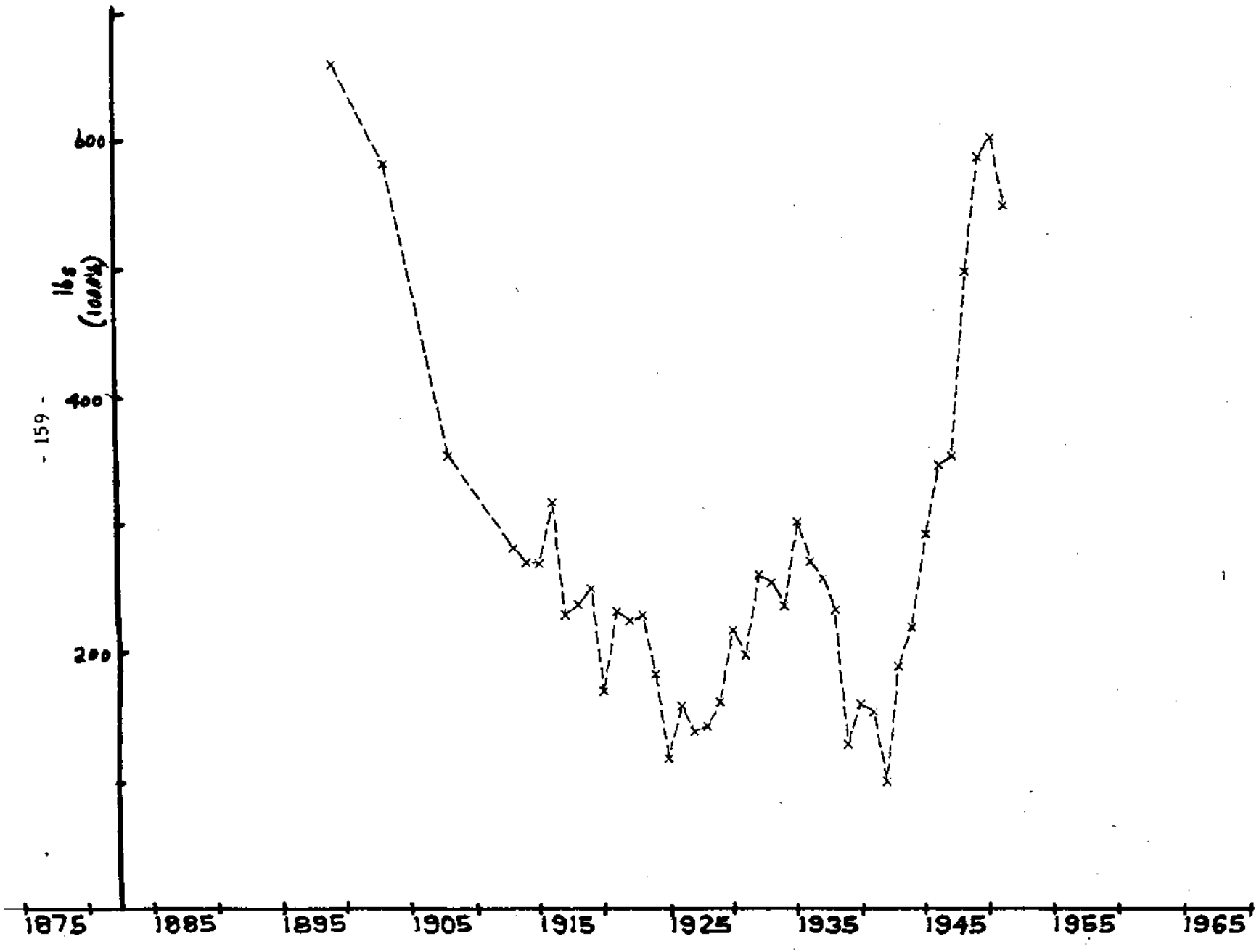


Lake Ontario Catch in Bay of Quinte

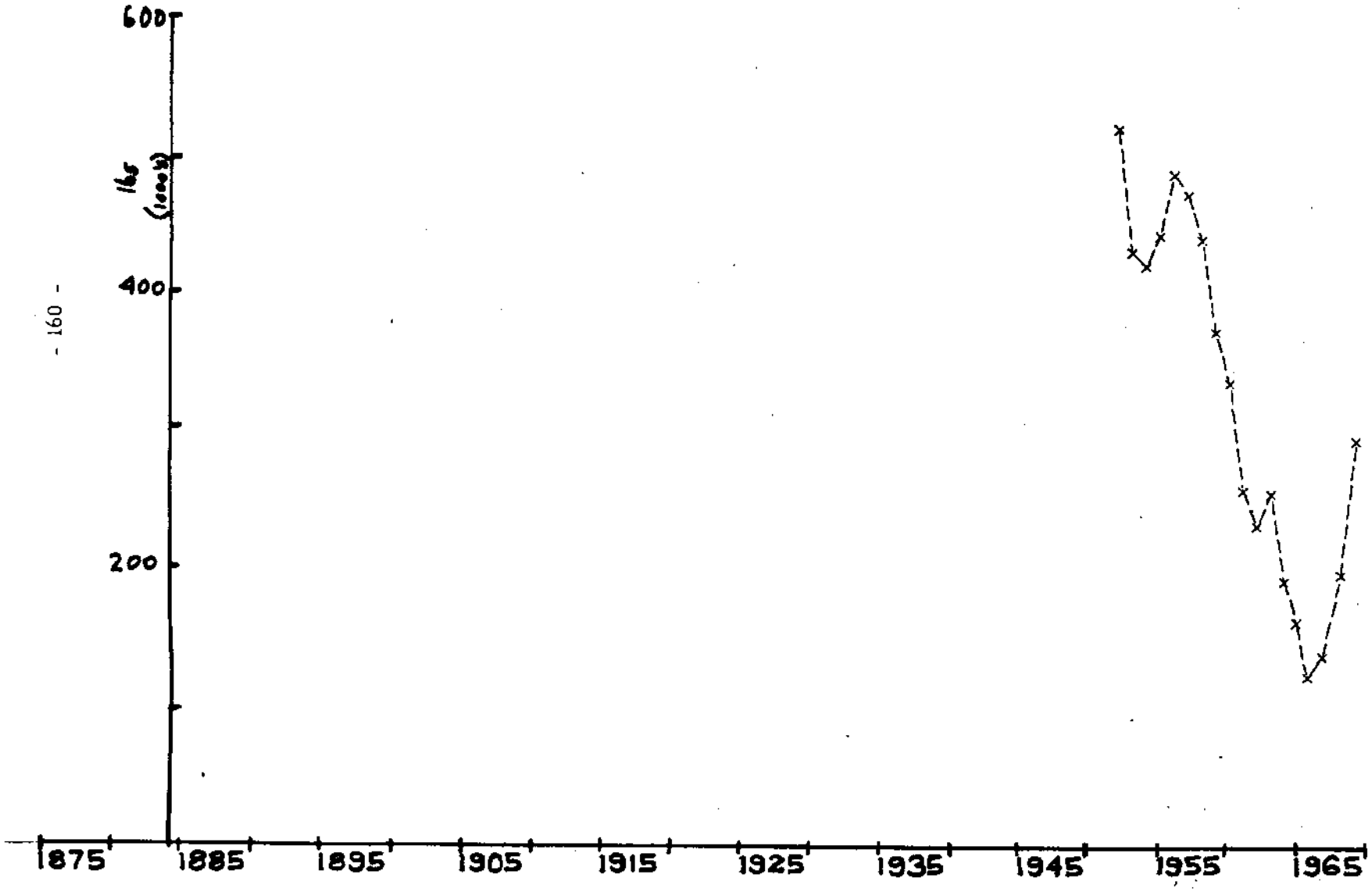


From Christie(1971 ms)

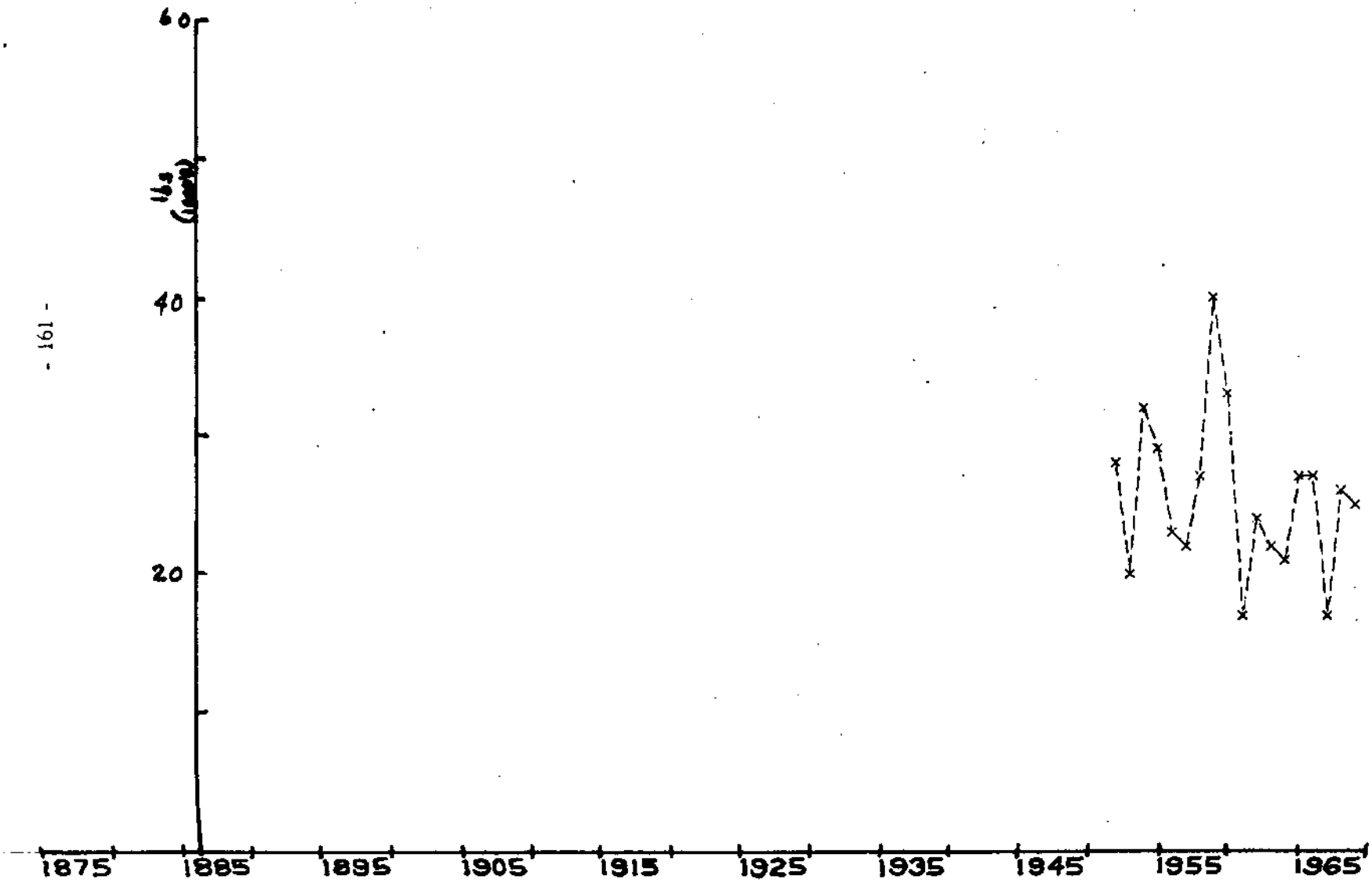
LAKE ONTARIO CATFISH-BULLHEAD

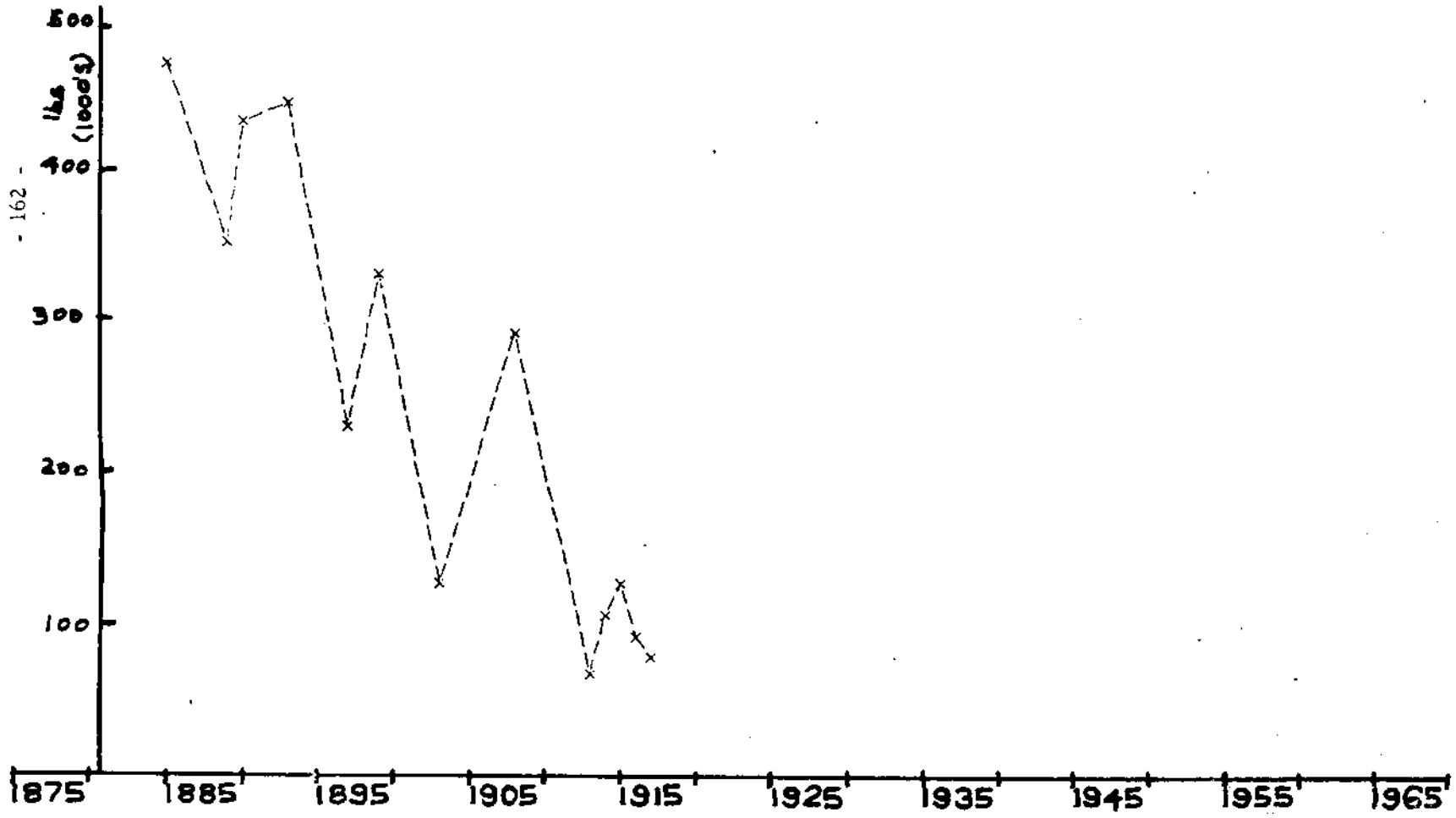


LAKE ONTARIO BULLHEADS

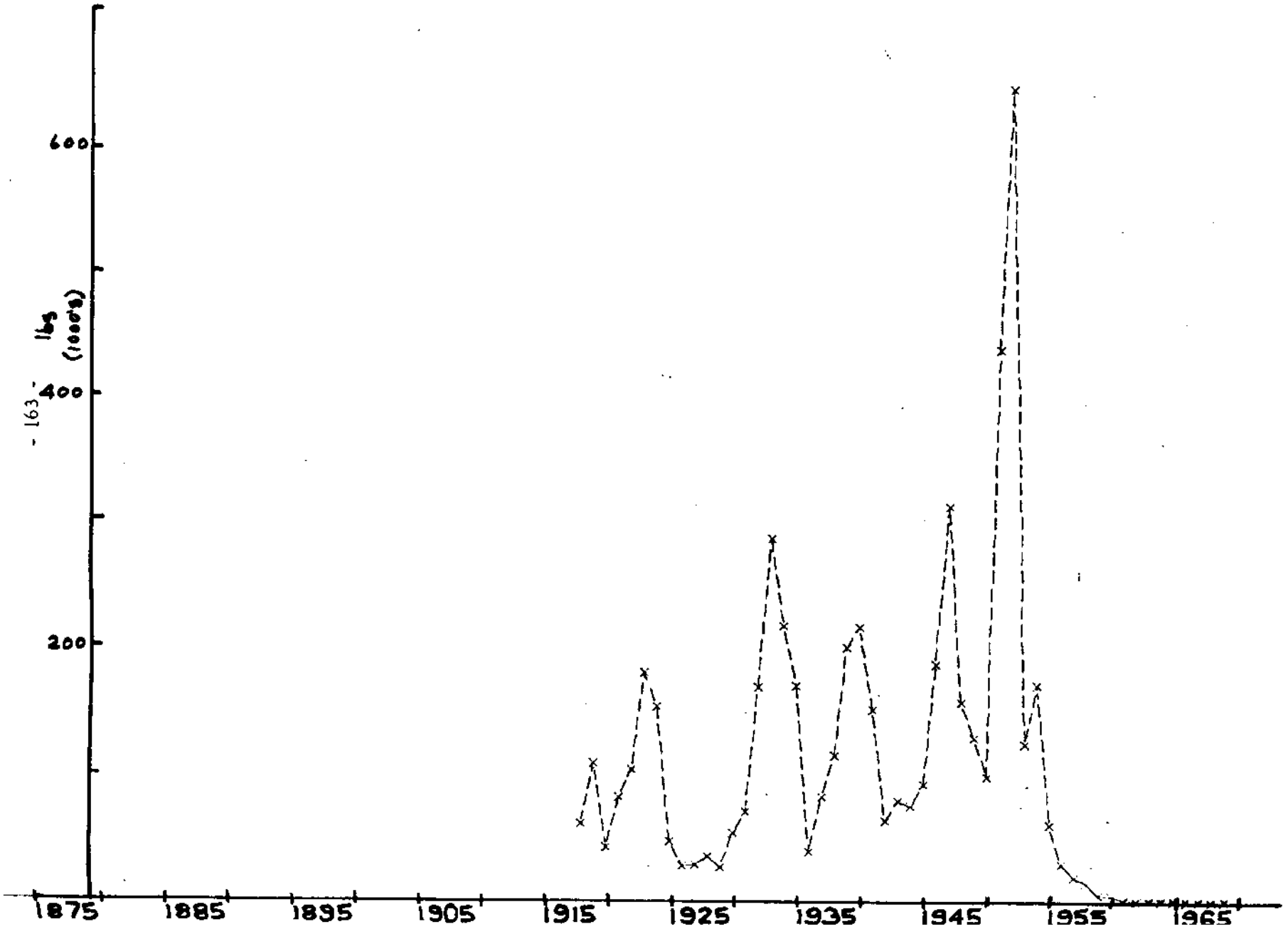


LAKE ONTARIO CATFISH

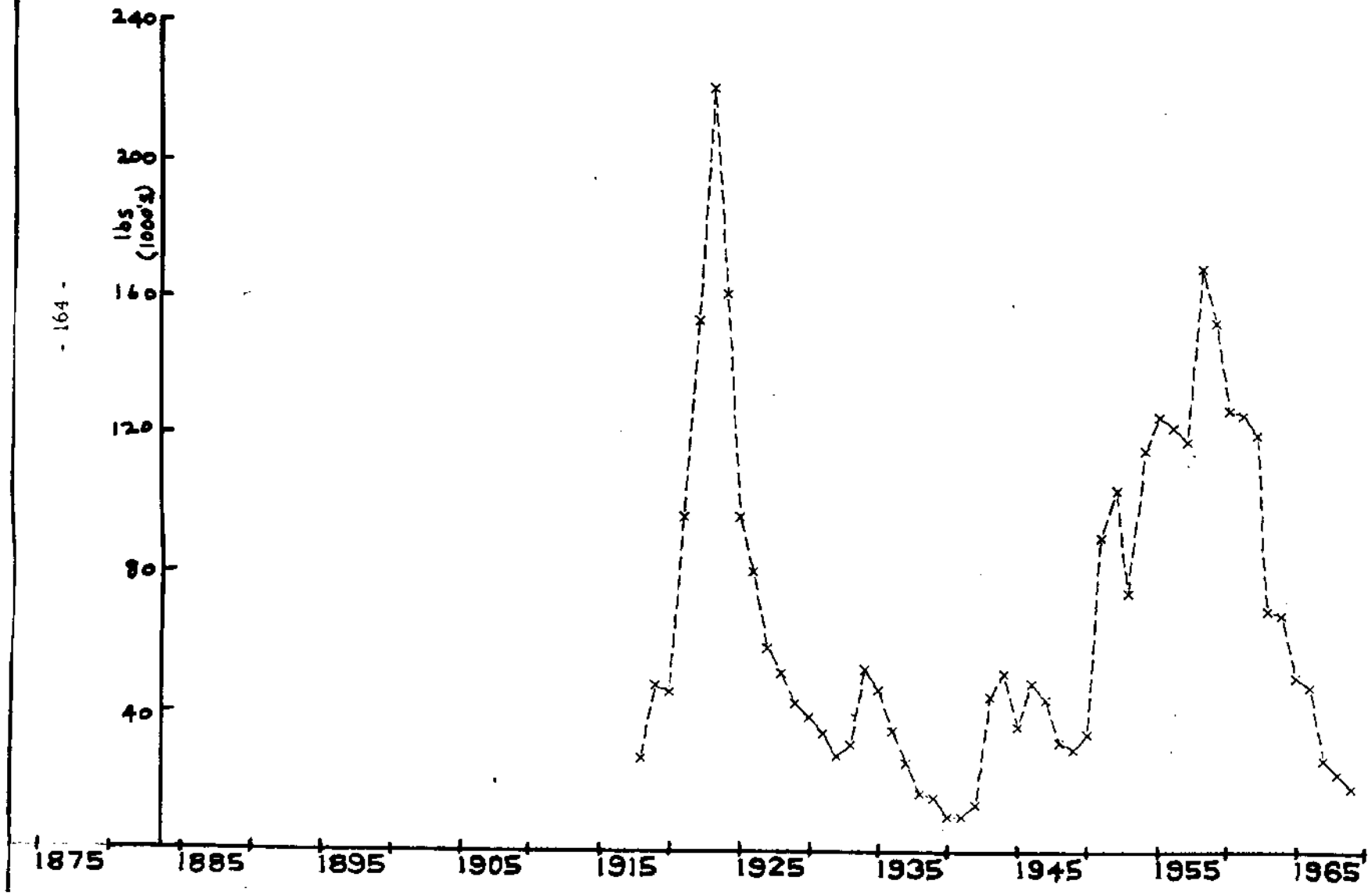



500
400
300
200
100
lbs (1000's)
1875
1885
1895
1905
1915
1925
1935
1945
1955
1965

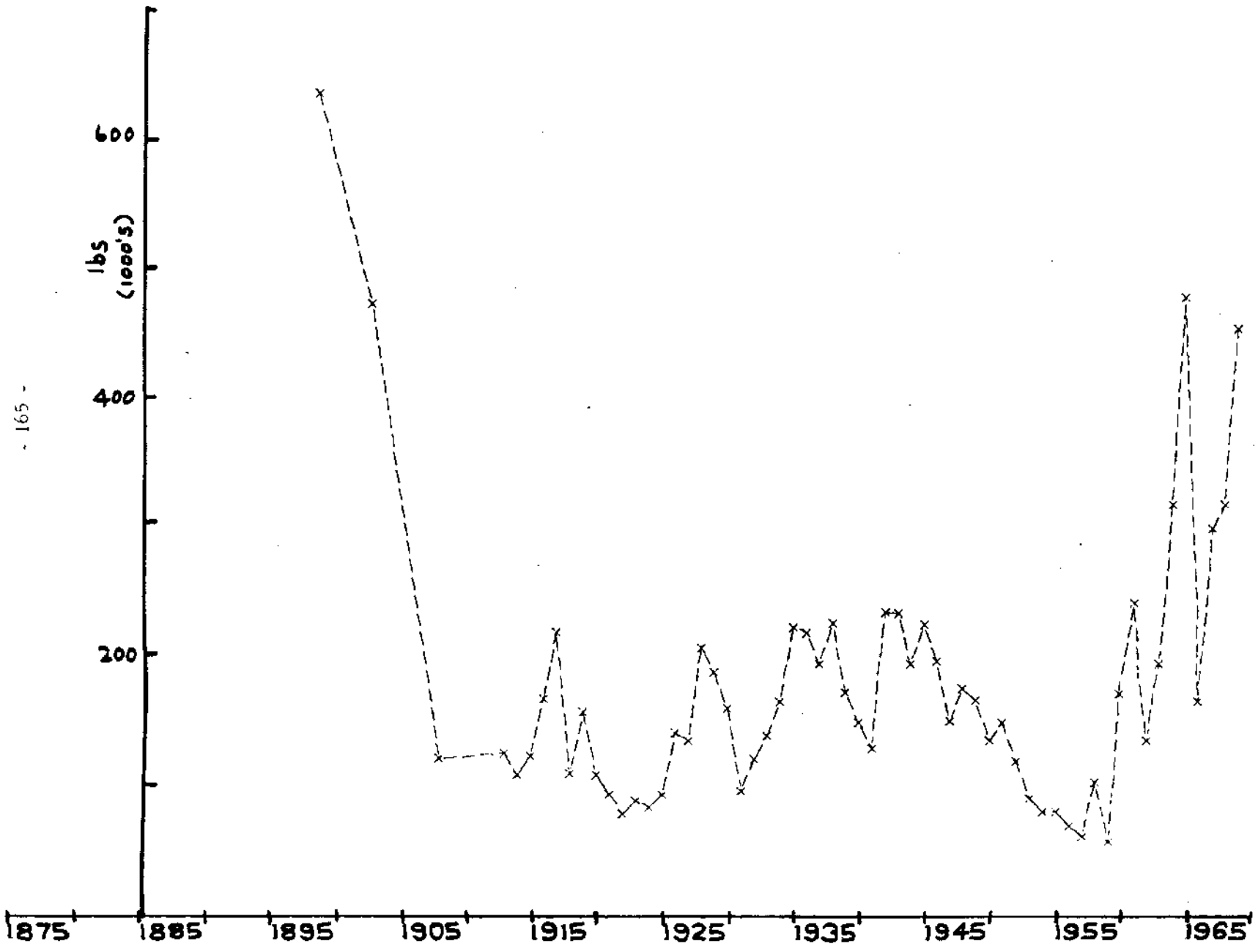
LAKE ONTARIO BLUE PIKE



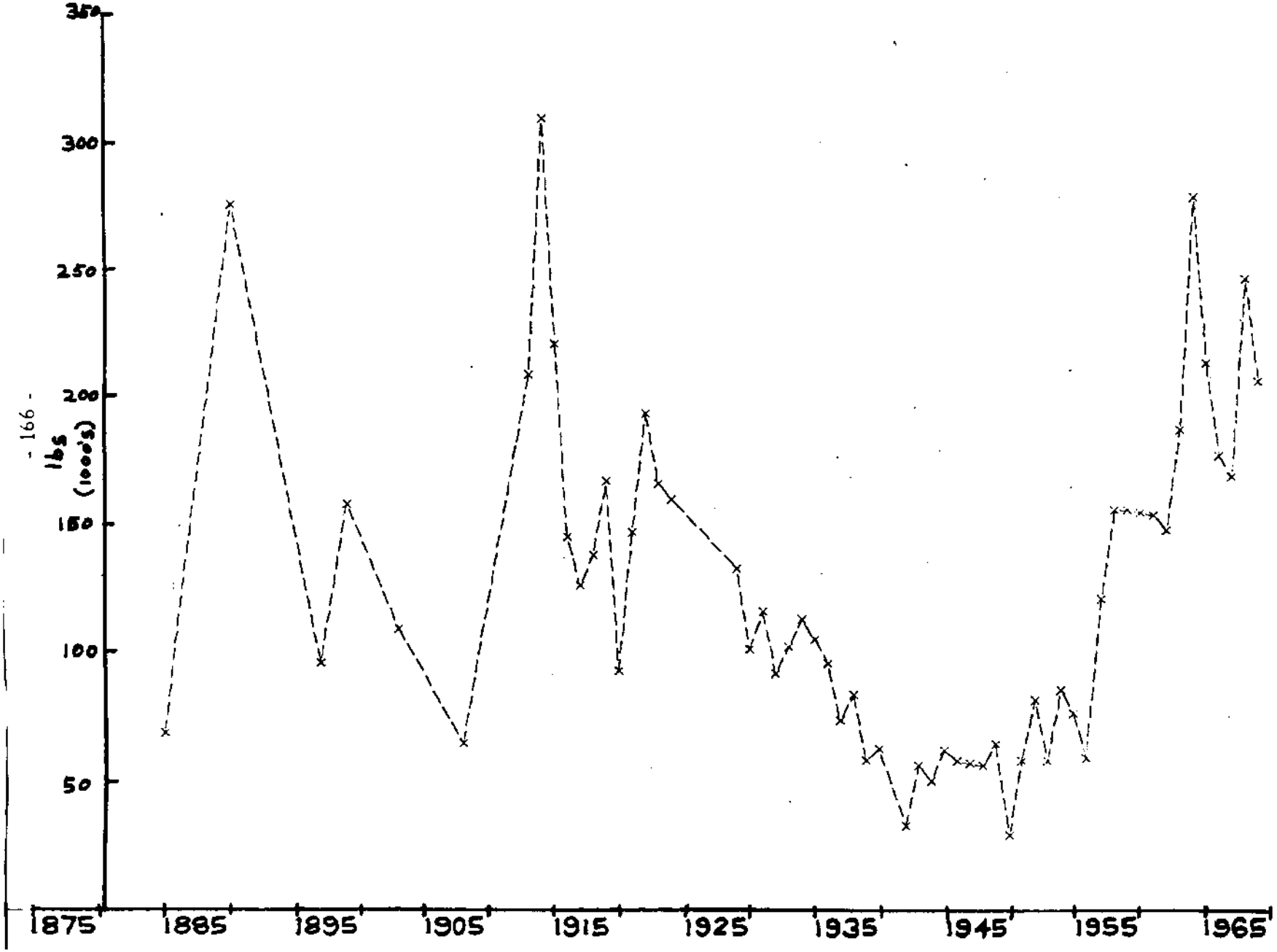
LAKE ONTARIO WALLEYE



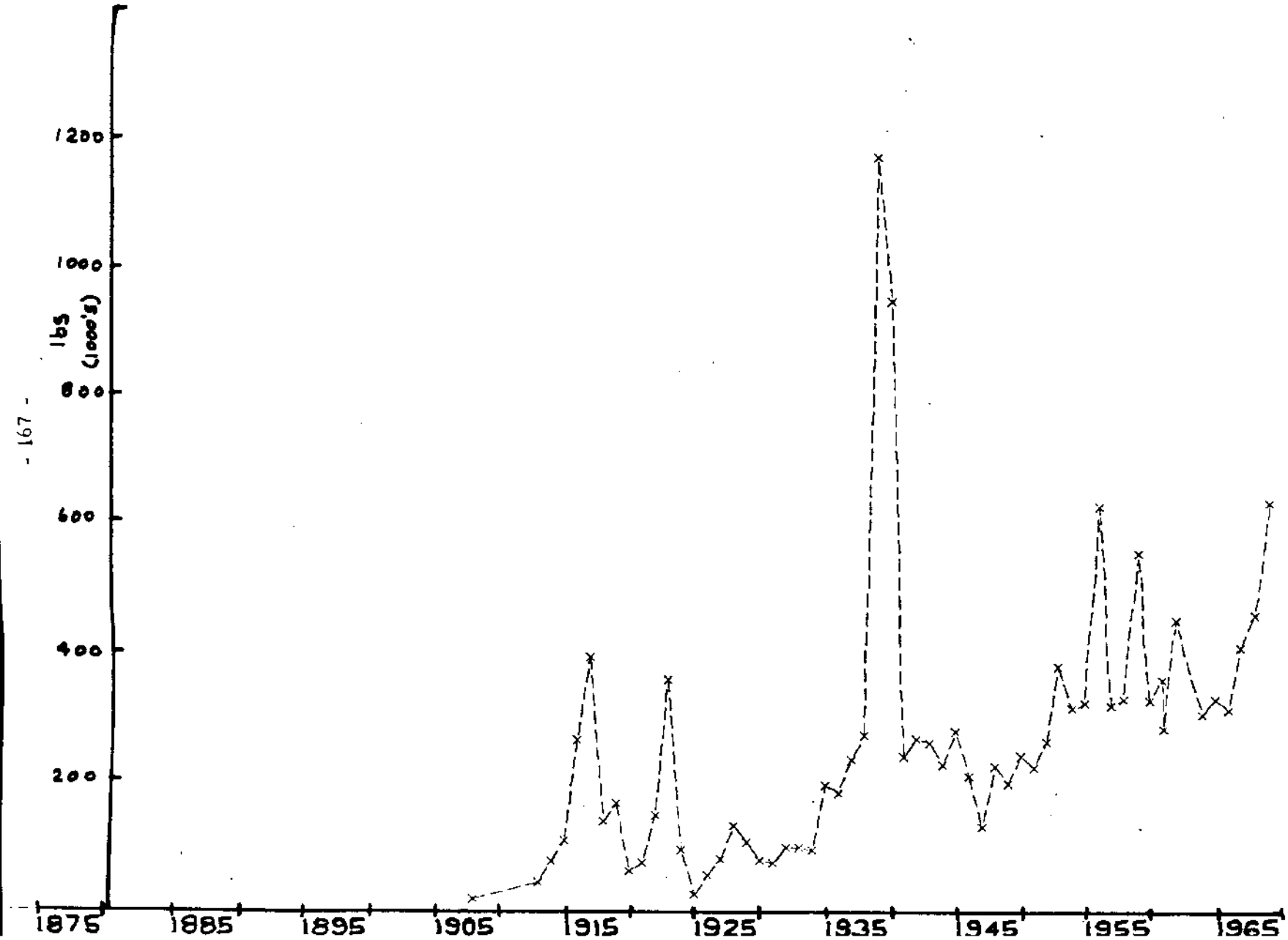
LAKE ONTARIO YELLOW PERCH



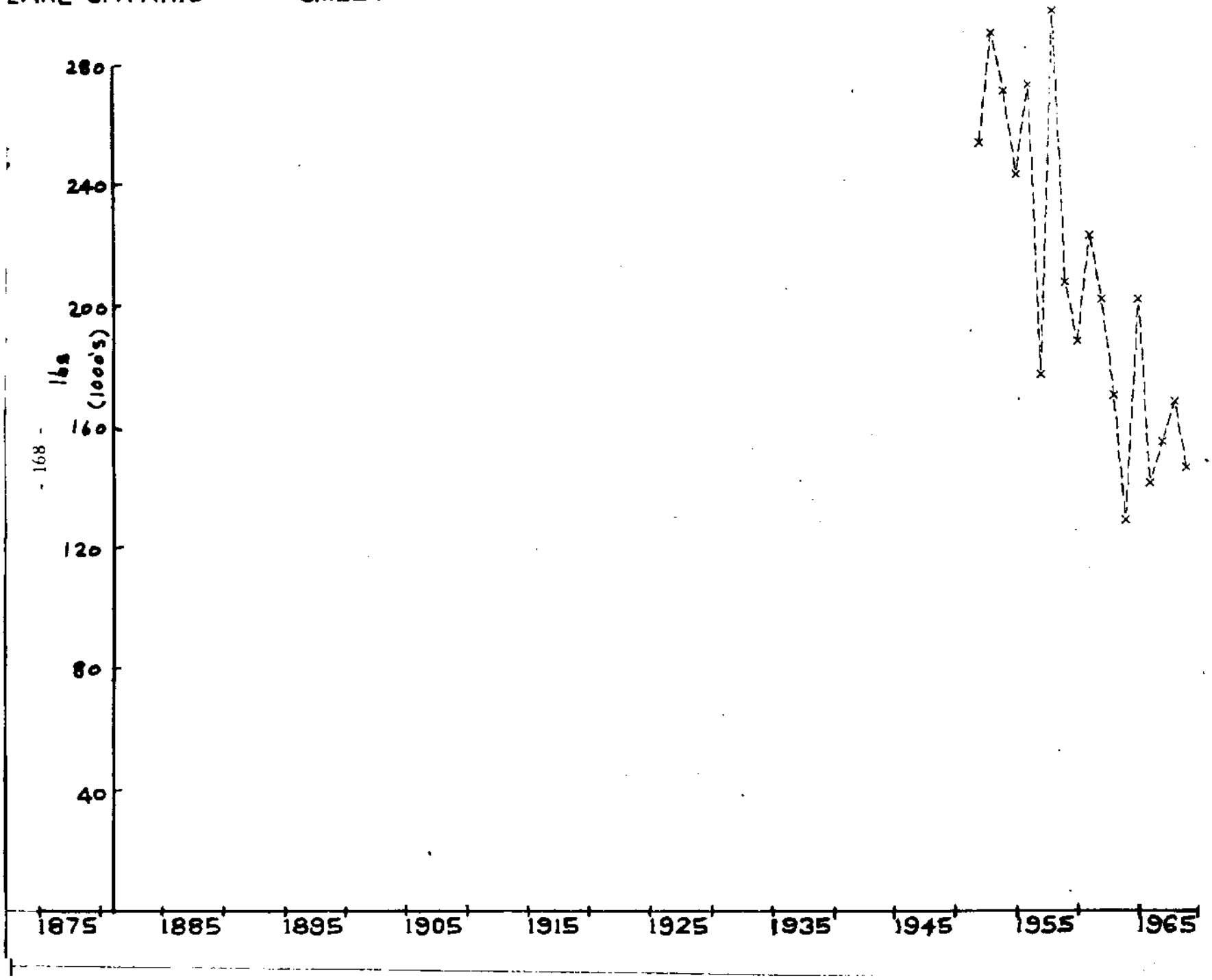
LAKE ONTARIO AMERICAN EEL



LAKE ONTARIO CARP



LAKE ONTARIO SMELT



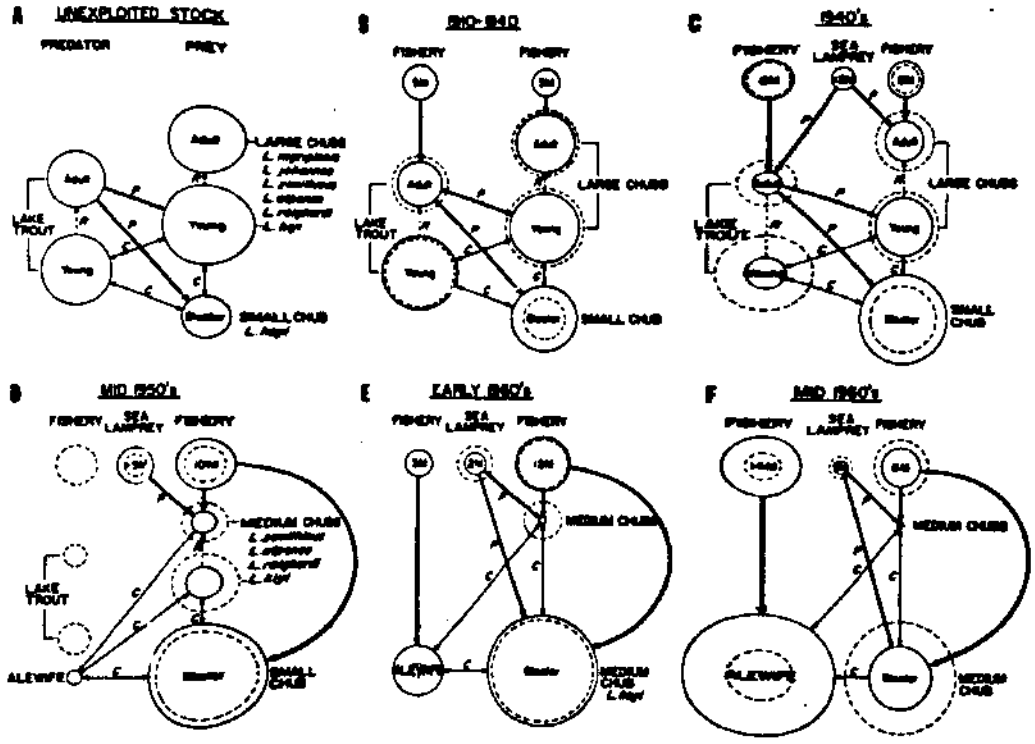


FIG. 5. Interrelations of major deepwater species of Lake Michigan before exploitation (A) and during the following periods: stable exploitation, 1910–40 (B); early influence of the sea lamprey, 1940's (C); maximum abundance of the sea lamprey, mid-1950's (D); maximum abundance of bloaters, early 1960's (E); maximum abundance of the alewife, mid-1960's (F). P = predation; C = food competition; and R = recruitment.

From Smith (1962)

Table 1.--Average pounds per acre of fish produced by the commercial fishery of the Great Lakes for various time intervals and years of record. Number of years of record for a time period is given in parentheses.

Period	Lake				
	Ontario	Erie	Huron	Michigan	Superior
Pre-1860	3.50-4.02[1/]	-	-	-	-
1879-89	1.46 (3)	8.54 (3)	1.36 (3)	1.69 (3)	0.40 (3)
1890-99	1.08 (4)	9.42 (4)	1.62 (10)	2.62 (4)	0.44 (4)
1900-09	0.80 (2)	6.49 (2)	1.69 (9)	2.93 (2)	0.71 (2)
1910-19	0.94 (7)	10.04 (6)	1.39 (8)	1.89 (7)	0.77 (7)
1920-29	0.98 (10)	7.19 (10)	1.27 (10)	1.43 (10)	0.75 (10)
1930-39	0.79 (10)	6.86 (10)	1.45 (10)	1.66 (10)	0.94 (10)
1940-49	0.60 (10)	6.38 (10)	0.79 (10)	1.61 (10)	1.09 (10)
1950-59	0.51 (10)	8.37 (10)	0.65 (10)	1.97 (10)	0.83 (10)
1960-69	0.47 (10)	8.21 (10)	0.55 (10)	2.39 (10)	0.62 (10)

1/ Estimates based on the average post alewife-sea lamprey commercial production of Lake Ontario (1879-89, high estimate; 1879-99, low estimate) increased by the ratio of the maximum production (1870-1909) and post alewife-sea lamprey production (1950-69) of Lake Huron.

From Smith (1971 ms)

Fishery

APPENDIX B

Creel census statistics for regions in the northeast portion of Lake Ontario and for three lakes and a reservoir in the region near Prince Edward County, Ontario and sport fisherman characteristics in Canada.

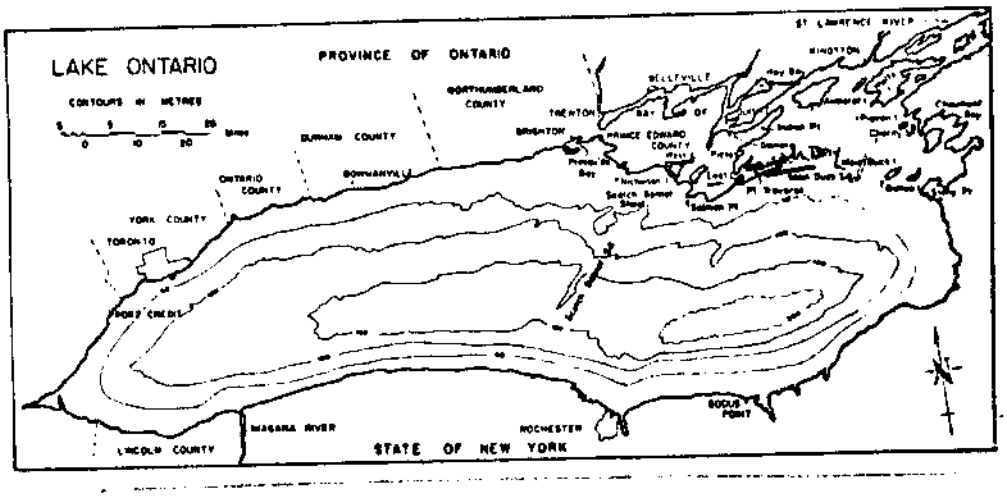
From Ontario Dept. of Lands and Forests

Tweed District Forester

and

Benson (1961)

Figure 1. Regions Surveyed for Angling Catch in the Prince Edward County AREa 1971



Bay Quinte area	Prince Edward County	Thousand Island area
South	Consecon Lake	Amherst
Smith	East Lake	Wolfe
Wellers	West Lake	Ivy Lea
Hay		

Table 1

Area	Year	Times Checked	No. of Anglers	Rod Hours	Walleye	Northern Pike	Smallmouth Bass	Largemouth Bass	C.U.E. for Game Fish	Yellow Perch	White Perch	Rock Bass	Pumpkinseed	Blue Gill	Black Crappie	Brown Bullhead	Channel Catfish	Carp	Sheepshead	American Eel	Gar Pike	White Bass	Bowfin	Maskinonge
Hay Bay (Sectors 10, 11 & 12)	1959								0.123															
	1960								0.083															
	1961								0.195															
	1962								0.062	C.U.E. For Walleye														
	1963								0.029															
Sector 10 only	1964	56	526	1054	20	3	9	0	0.030															
	1965																							
	1966	17	351	no hours	20	4	8	0	---															
	1967	28	1046	2129	74	1	10	0	0.039															
	1968	23	567	1599	50	16	9	0	0.047															
	1969	19	512	904	30	28	15	0	0.081															
	1970	28	228	509	9	4	14	2	0.057	29	206	8	12			6	2							
	1971	36	228	426	13	4	15	0	0.075	50	105	4				15						3		1

From Ontario Department Lands and Forests
Tweed district forester

Area	Year	Times Checked	No. of Anglers	Rod Hours	Walleye	Northern Pike	Smallmouth Bass	Lárgemouth Bass	C.U.E. for Game Fish	Yellow Perch	White Perch	Rock Bass	Pumpkinseed	Blue Gill	Black Crappie	Brown Bullhead	Channel Catfish	Carp	Sheepshead	American Eel	Gar Pike	White Bass	Bowfin	Maskinonge
outh Bay	1970	18	32	55	0	0	2	0	0.036	50	0	23	12											
	1971	35	79	180	0	28	2	3	0.184	47	0	1	1											
mith Say	1970	22	153	201	0	60	4	1	0.216	90	32	18	3			1								
	1971	41	394	945	0	136	22	15	0.183	422	0	62	6			6								
rent iver - elow #1 am	1959								0.202															
	1960								0.298															
	1961								0.24[illegible]															
	1962								0.269															
	1963								0.116															
	1964	57	583	1491	215	2	16	0	0.157															
	1965																							
	1966	16	132	no hours	55	0	19	1																
	1967	23	245	459	132	0	4	0	0.298	---	---	---	---	Not	Recorded	---	---	---	---	---	---	---		
	1968	15	193	452	126	0	25	5	0.345	---	---	---	---	Not	Recorded	---	---	---	---	---	---	---		
	1969	24	404	999	183	5	79	1	0.268	---	---	---	---	Not	Recorded	---	---	---	---	---	---	---		
	1970	26	360	788	176	1	24	3	0.259	19	488	11	13			6	4	1				4		
	1971	43	438	1029	133	0	69	0	0.196	116	246	11	66		4	2	1	2				1	2	

* Includes both Bluegill and Pumpkinseeds.

TABLE 3

Area	Year	Times Checked	No. of Anglers	Rod Hours	Walleye	Northern Pike	Smallmouth Bass	Largemouth Bass	C.U.E. for Game Fish	Yellow Perch	White Perch	Rock Bass	Pumpkinseed	Blue Gill	Black Crappie	Brown Bullhead	Channel Catfish	Carp	Sheepshead	American Eel	Gar Pike	White Bass	Bowfin	Maskinonge	Rainbow Trout	Coho Salmon
o. 1 Dam	1968	13	58	99	7	0	1	0	0.081							2		2		11			1			
t Trenton	1969	14	260	788	94	0	3	29	0.159	----------					-Not Recorded											
Shoreline	1970	21	140	175	6	0	1	1	0.046	15	87	27	25			6		3		3	2	1				
	1971	42	344	526	21	0	24	0	0.086	134	67	46	66			23		9							1	1
Vest Lake	1968	17	539	1377	215	113	22	14	0.264	----------					-Not Recorded											
	1969	20	643	1527	142	122	70	35	0.242	----------					-Not Recorded											
	1970	29	752	1870	114	124	16	20	0.147	354	79	80	136		26	83			1	3		3	3			
	1971	43	1086	2226	154	98	12	82	0.155	400	133	158	341		9	63				1		5	6			
Vellers Bay	1968	16	203	434	24	49	9	4	0.195	----------					-Not Recorded											
	1969	17	342	932	25	76	31	20	0.163	----------					-Not Recorded											
	1970	33	354	719	5	58	28	12	0.143	210	24	44	109	19												
	1971	37	311	865	16	36	22	7	0.094	6	40			75		50										
Consecon Lake	1969	22	342	1031	71	197	9	3	0.272	25		83	121	2		2				3	1		1			
	1970	30	332	1175	153	123	5	1	0.240	25		18	71													
	1971	33	242	727	27	110	5	0	0.195	23		50	130													
East Lake	1970	25	377	705	116	104	19	6	0.346	57	6	101	133	*		4					2	5				
	1971	40	660	1388	263	147	15	37	0.340	105	7	127	283	*	1	12										

TABLE 4

Area	Year	Times Checked	No. of Anglers	Rod Hours	Walleye	Northern Pike	Smallmouth Bass	Largemouth Bass	C.U.E. for Game Fish	Yellow Perch	White Perch	Rock Bass	Pumpkinseed	Blue Gill	Black Crappie	Brown Bullhead	Channel Catfish	Carp	Sheepshead	American Eel	Gar Pike	White Bass	Bowfin	Maskinonge
Amherst Island	1971	6	106	172	0	1	77	4	0.480	23														
Wolfe Island	1971	7	237	550	0	12	432	0	0.808	33						1								
Ivy Lea	1971	48	1448	2293	0	454	438	43	0.413	845	0	1,098	235	449	40	3	0	0	0	0	0	0	0	2

TABLE 5

Area	Year	Times Checked	Total No. of A Anglers	Total Rod Hours	Rod Hrs. Walleye	No. of Walleye	C.U.E. Walleye	Rod Hours Pike	No. of Pike	C.U.E. Pike	Rod Hours S.M. Bass	No. S.M. Bass	C.U.E. S.M. Bass	Rod Hours L.M. Bass	No. L.M. Bass	C.U.E. L.M. Bass	Rod Hrs. Anything or Panfish	C.U.E. Gamefish
Consecon Lake	1971	33	242	727	338	27	0.08	343	87	0.252	80	10	0.125	0	0	0.0	10	0.188
West Lake	1971	43	1088	2226	1181	111	0.093	784	66	0.086	80	4	0.050	192	66	0.346	306	0.111
Wellers Bay	1971	37	311	865	225	13	0.057	281	36	0.104	163	29	0.178	59	6	0.103	156	0.109
East Lake	1971	40	660	1388	915	250	0.285	281	39	0.139	50	0	0.0	48	17	0.354	141	0.236
Trent River Below #1 Dam	1971	43	438	1029	951	133	0.139	0	0	0	6	7	1.167	0	0	0.00	79	0.146
Trent River At Dam #1	1971	42	344	526	333	21	0.063	0	0	0	4.5	16	3.556	0	0	0.00	189	0.107
Bay Bay	1971	36	228	426	370	13	0.035	22.5	1	0.044	40.5	8	0.198	0	0	0.00	56	0.051
Smith Bay	1971	41	394	945	0	0	0.00	680	136	0.200	68	18	0.267	71	13	0.184	154	0.204
South Bay	1971	35	79	180	0	0	0.00	111	28	0.255	18	2	0.111	13	3	0.231	38	0.234
Timbers Island	1971	6	106	172	0	0	0.00	0	0	0.00	171	77	0.450	0	0	0.00	0.5	0.450
Wolfe	1971	7	237	550	1.5	0	0.00	18	1	0.055	528	432	0.818	0	0	0.00	2.0	0.790

USA COMMERCIAL CATCH DATA (pounds) LAKE ONTARIO AND CHAUMONT BAY

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
NORTHERN PIKE					67	103	55	61		
					-	-	-	-		
SAUGER			25							
			-			20				
BULLHEADS	1954	3374	823	1318	539	112	98	30	83	12
	108864	95107	84751	70470	47028	44161	44376	39773	27354	26340
EEL	463	-	-	183	38	-	-	-	-	57
	27415	20752	24425	30132	23982	18675	32750	25157	35305	35109
YELLOW PERCH	13939	15564	28257	43477	9774	40045	62294	60179	1334	2830
	20624	12560	11908	24743	11763	12512	13926	7348	13933	9599
SUCKERS	245	532	192	470	2925	-	25	60	1092	594
	17999	13100	11975	17082	11408	11017	13376	5715	9281	7918
SUNFISH	50	15	10	185	35	-	-	-	-	-
	16387	15632	15723	18880	8774	8772	11733	7715	12347	13615
CARP	785	26	152	1548	73	-	-	-	-	32
	8982	18191	28813	47578	38271	36183	39128	20645	15241	15149
WHITEFISH	10503	5917	19799	59071	26132	31511	16273	13972	2117	2330
	125	56	187	88	535	169	234	147	104	-
BLUE PIKE	4033	1329	4475	402	29	-	-	149	9	-
	587	1626	151	90	48	42	-	16	-	24
STURGEON	1365	573	558	1941	203	408	85	705	-	140
	17	85	-	-	-	-	-	76	100	-
ROCK BASS	569	1072	340	149	212	-	-	95	748	160
	6595	2305	2372	9047	3562	6359	3603	2319	6765	8259
WHITE BASS	5933	3580	7894	7024	7920	2527	2700	-	-	-
	55	103	242	832	1060	1497	945	738	859	541
YELLOW PIKE	394	958	179	822	14127	1580	1560	4265	1285	100
	1205	470	380	155	313	891	980	635	2644	1083
SMELT	595	37	92	168	215	205	369	64	90	6
	-	-	-	35	-	-	114	30	71	-
CATFISH	40	-	38	719	20	-	-	-	-	1440
	541	788	965	1380	1540	2072	797	553	584	1523
CALICO BASS	20	15	-	-	19	-	-	-	-	-
	636	426	803	315	560	1082	673	555	1345	2074
LAKE TROUT	909	48	4450	5080	1198	-	-	-	35 FISH	12 FISH
	-	15	7	-	-	-	-	-		
LING	-	-	60	-	-	-	-	-	-	-
	204	233	279	1041	127	871	372	-	-	48
DOGFISH	-	-	-	-	-	-	-	-	-	-
	6480	3519	-	2178	2815	1271	1562	803	1520	339
WHITE PERCH	-	1800	-	15	710	100	-	12454	95047	138352
	186	602	588	1885	420	5584	3482	3863	5051	7519
SHEEPSHEAD	-	-	-	-	35	-	-	-	-	-
	222	116	108	-	-	-	26	115	80	129
HERRING	-	523	137	2033	2260	3549	6641	6325	2502	1505
	-	-	-	482	405	1421	1418	2127	-	-
ALEWIFE	1660	4330	-	-	-	-	-	-	-	-
	492	355	-	-	-	-	-	-	-	-
Lake Ontario TOTAL	43457	39693	67481	124605	66531	80140	90100	98359	104307	147582
Chaumont Bay TOTAL	217616	186041	183667	226433	152812	152619	169495	118330	132840	129591

From New York Department Environmental Conservation

For each fish, first number is catch poundage in Lake Ontario; bottom number is catch poundage for Chaumont Bay.

Table 1—Number of persons 14 years of age and older who Fished and Hunted in 1961

Grouping	Total number of persons 14 and over in Canada*		Persons who fished and/or hunted		Persons who fished and hunted		Persons who fished only		All persons who fished		Persons who hunted only		All persons who hunted	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Total—All Provinces...	12,140,000	100.0	1,525,650	12.6	576,270	4.7	734,795	6.0	1,311,065	10.8	214,585	1.8	790,855	6.5
REGIONS														
Atlantic	1,226,000	100.0	169,620	13.8	80,640	6.6	53,495	4.4	134,135	10.9	35,485	2.9	116,125	9.5
Quebec	3,467,000	100.0	272,510	7.9	107,140	3.1	131,140	3.8	238,280	6.9	34,230	1.0	141,370	4.1
Ontario	4,249,000	100.0	578,540	13.6	206,510	4.9	328,290	7.7	534,800	12.6	43,740	1.0	250,250	5.9
Prairies	2,073,000	100.0	313,260	15.1	114,580	5.5	123,010	5.9	237,590	11.5	75,670	3.6	190,250	9.2
British Columbia	1,125,000	100.0	191,720	17.0	67,400	6.0	98,860	8.8	166,260	14.8	25,460	2.3	92,860	8.2
AGE GROUPS														
14-19	1,788,000	100.0	184,970	10.3	70,400	3.9	87,740	4.9	158,140	8.8	26,830	1.5	97,230	5.4
20-24	1,200,000	100.0	160,430	13.4	71,150	5.9	57,795	4.8	128,945	10.7	31,485	2.6	102,635	8.6
25-34	2,371,000	100.0	400,480	16.9	164,830	7.0	175,330	7.4	340,160	14.3	60,320	2.5	225,150	9.5
35-44	2,321,000	100.0	385,690	16.6	138,950	6.0	201,040	8.7	339,990	14.6	45,700	2.0	184,650	8.0
45-54	1,865,000	100.0	244,210	13.1	82,960	4.4	129,150	6.9	212,110	11.4	32,100	1.7	115,060	6.2
55-64	1,286,000	100.0	108,370	8.4	36,940	2.9	58,510	4.5	95,450	7.4	12,920	1.0	49,860	3.9
65 and over	1,309,000	100.0	41,500	3.2	11,040	0.8	25,230	1.9	36,270	2.8	5,230	0.4	16,270	1.2
SEX														
Male	6,039,000	100.0	1,309,260	21.7	541,290	9.0	559,465	9.3	1,100,645	18.2	208,595	3.4	749,795	12.4
Female	6,101,000	100.0	216,390	3.5	34,980	0.6	175,330	2.9	210,420	3.4	5,990	0.1	41,000	0.7

*These estimates are derived from the continuing Labour Force Survey for February 1962 (the month in which this survey was conducted).

From Benson (1961)

Table 2—Number of persons by types of Fishing and Hunting

Grouping	Total number of persons 14 and over in Canada*		Fishing						Hunting					
			Freshwater		Salt Water Atlantic		Salt Water Pacific		Big game		Small game		Waterfowl	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Total—All Provinces...	12,140,000	100.0	1,256,615	10.4	57,280	0.5	92,040	0.8	461,020	3.8	417,390	3.4	344,900	2.8
REGIONS														
Atlantic	1,226,000	100.0	126,585	10.3	29,650	2.4	**		88,010	7.2	52,470	4.3	36,800	3.0
Quebec	3,467,000	100.0	235,270	6.8	14,340	0.4	**		95,840	2.8	79,640	2.3	38,750	1.1
Ontario	4,249,000	100.0	533,600	12.6	10,760	0.2	**		107,130	2.5	171,360	4.0	118,080	2.8
Prairies	2,073,000	100.0	237,020	11.4	**		**		117,630	5.7	61,450	3.0	104,740	5.0
British Columbia	1,125,000	100.0	124,140	11.0	**		84,970	7.6	52,410	4.7	52,470	4.7	46,530	4.1
SEX														
Male	6,039,000	100.0	1,058,470	17.5	51,620	0.8	74,910	1.2	444,250	7.4	394,040	6.5	330,060	5.5
Female	6,101,000	100.0	198,145	3.2	**		17,130	0.3	16,770	0.3	23,350	0.4	14,840	0.2

*These estimates are derived from the continuing Labour Force Survey for February 1962 (the month in which this survey was conducted).

**Less than 10,000.

Table 6—Recreation Days provided by Sport Fishing

Grouping	Freshwater	Salt Water		All fishing
		Atlantic	Pacific	
Total—All Provinces	18,229,100	405,000	1,119,400	19,753,500
REGIONS				
Atlantic	1,520,500	260,800	*	1,784,300
Quebec	3,606,200	71,900	*	3,678,600
Ontario	8,440,100	48,400	*	8,490,500
Prairies	2,630,000	*	*	2,658,100
British Columbia	2,032,300	*	1,095,800	3,142,000

*Less than 20,000.

Table 7—Recreation Days provided by Hunting

Grouping	Big game	Small game	Waterfowl	All hunting
Total—All Provinces	3,709,300	3,991,800	3,004,200	10,705,300
REGIONS				
Atlantic	910,500	464,000	311,100	1,685,600
Quebec	743,100	657,800	317,800	1,718,700
Ontario	860,000	1,885,500	1,085,600	3,831,100
Prairies	690,400	467,900	852,100	2,010,400
British Columbia	505,300	516,600	437,600	1,459,500

Table 13—Comparison of seasonal and daily expenditures of Sport Fishermen and Hunters in Canada and the U.S.A.[1]

Category	CANADA[2] (Persons 14 years of age and older)		U.S.A.[3] (Persons 12 years of age and older)			
	1961		1960		1955	
	Season	Day	Season	Day	Season	Day
	$	$	$	$	$	$
All sport fishing and hunting	180.25	9.03	126.57	5.85	114.42	5.03
All sport fishing	143.13	9.50	106.26	5.78	91.98	4.82
Freshwater fishing	138.30	9.53	95.25	5.36	77.38	4.21
All hunting	110.44	8.16	79.34	6.03	79.49	5.53
Big game hunting	85.42	10.62	55.07	8.82	73.38	10.50
Small game hunting	49.62	5.19	59.98	5.25	50.30	4.16
Waterfowl hunting	79.03	9.07	45.74	5.90	59.79	5.95

[1]A major source of difference between the Canadian and U.S. surveys is the approach to vehicle mileage. The U.S. surveys used an estimate of "out of pocket" expenses, while the Canadian survey allowed a fixed amount of $0.075 per car mile. Automobile or private vehicle expenses amount to 12.8 per cent of the total expenditures of the U.S. 1950 survey; to 13.8 per cent of the U.S. 1960 survey; and to 21.7 per cent of the Canadian 1961 survey.

[2]This survey.

[3]U.S. Department of the Interior, (1956 and 1961).

From Benson (1961)
Fishing and Hunting in Canada

Fishery

APPENDIX C

Time Schedule for selected events in the history of Lake Ontario

Navigation Channels which may have caused changes in the fish fauna of Lake Ontario.

1535 Jacques Cartier, navigator and seaman from St. Malo, sails his three frail craft across the Atlantic and up the St. Lawrence River, and lays claim to the new land in the name of His Most Christian Majesty, Francis I of France.*

1819 Champlain Canal linking the Atlantic Ocean and St. Lawrence River.

1824 Welland Ship Canal. In 1929 the Welland Canal opens for traffic. Forty locks make possible the 326 foot lift between Lake Ontario and Lake Erie and take navigation around the Niagara Falls.*

1825 Erie Barge Canal linking the Atlantic and Lake Erie. The digging of the Erie Canal (generally scoffed at as Clinton's Folly) began in 1816.*

1828 Oswego Canal linking the Atlantic Ocean and Lake Ontario opens.

1829 Cayuga Seneca canal linking the Finger Lakes and Lake Erie opens.

1838 Chenango Canal linking the Atlantic Ocean and Lake Ontario opens.

1840 Genessee Valley canal linking the Atlantic Ocean and Lake Ontario opens.

1959 The St. Lawrence Seaway is opened (April 25). A joint Canadian-American project, the Seaway enables most ocean-going vessels to sail up the St. Lawrence River and into the Great Lakes.*

*From Anderson(1969) Appendix I, from Hubbs and Lagler(1958) in Anderson(1969)

Date Line of Lake Ontario Fishery Succession

The chronology of major successional events outlined in the foregoing is as follows:

1830-1840	Collapse of salmon stocks
1860's	Reduction of ciscoes, invasion of alewife
1880's	Invasion of carp
1890-1910	Whitefish, trout, burbot scarce, ciscoees abundant.
1920's	Whitefish, trout, burbot, lamprey abundant, ciscoes scarce.
1930's	Trout, burbot, whitefish, herring decline, ciscoes increase.
1940's	Trout, burbot, herring, ciscoes collapse. Smelt rise to dominance.
1950's	White bass, blue pike, deepwater sculpin disappear, walleye dominant, whitefish abundant.
1960's	White perch reach dominance, walleye decline, Bay of Quinte whitefish collapse, yellow perch abundant in open Lake Ontario.

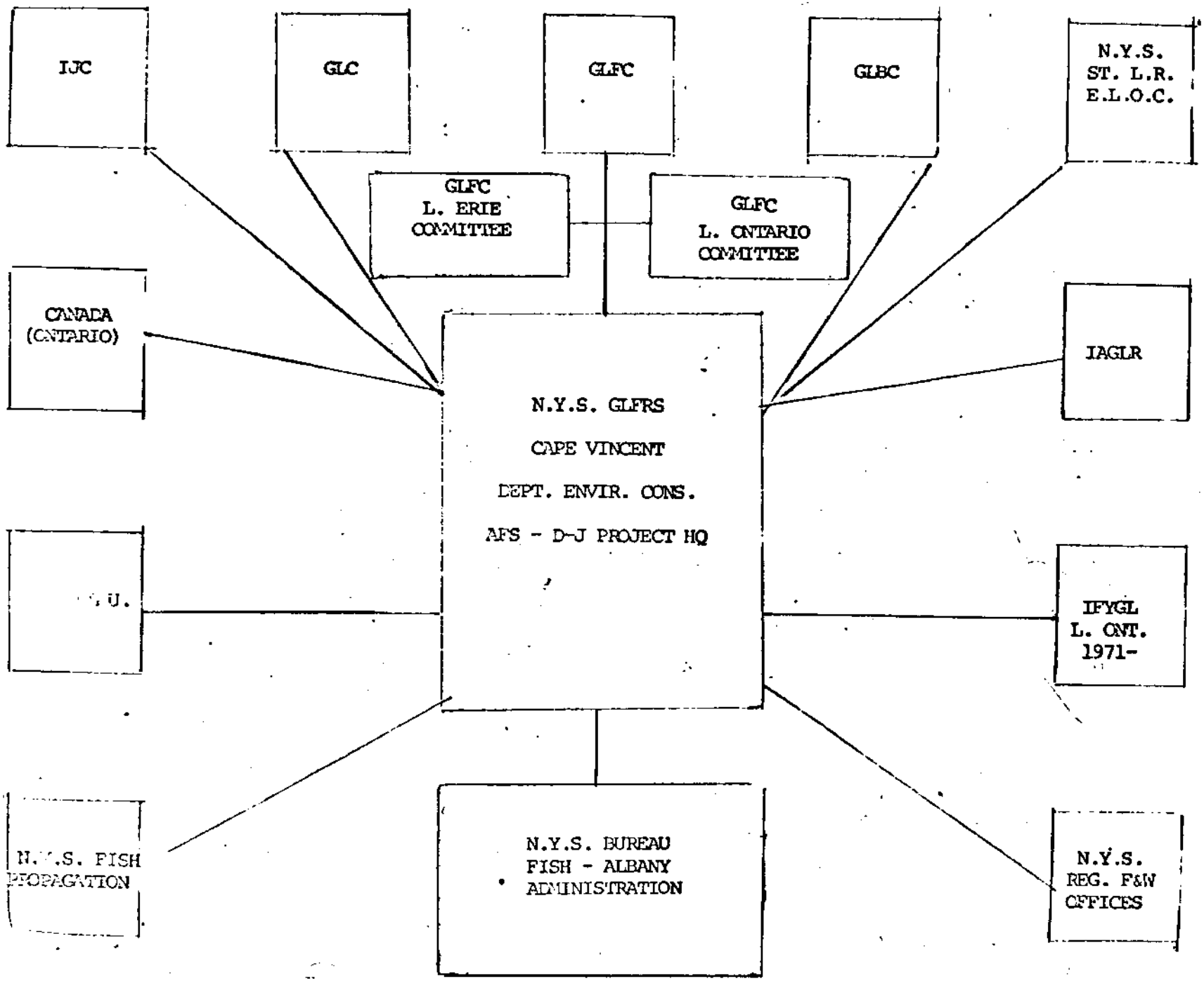
From Christie (1971 ms)

Fishery

APPENDIX D

Organization Complex dealing with the Fisheries of Lake Ontario

From Neth (1972)


IJC
GLC
GLFC
GLBC
N.Y.S.
ST. L.R.
E.L.O.C.
GLFC
L. ERIE
COMMITTEE
GLFC
L. ONTARIO
COMMITTEE
CANADA
(ONTARIO)
IAGLR
N.Y.S. GLFRS
CAPE VINCENT
DEPT. ENVIR. CONS.
AFS - D-J PROJECT HQ
U.S.
IFYGL
L. ONT.
1971-
N.Y.S. FISH
PROPAGATION
N.Y.S. BUREAU
FISH - ALBANY
ADMINISTRATION
N.Y.S.
REG. F&W
OFFICES

IMPORTANCE OF THE PROPOSED "FISH MANAGEMENT IN NEW YORK GREAT LAKES" STUDY TO THE GREAT LAKES BASIN AND NEW YORK STATE'S COMPREHENSIVE FISH MANAGEMENT PROGRAMS

Anadromous, as well as other salmonid species, offer the greatest potential for providing quality and quantity sport fishing of great economic importance in New York State's Great Lakes waters. Such species also offer the possibility of producing a controlled commercial fishery at some future date. It is apparent that any successful anadromous fish program in these waters must be coordinated with an overall Great Lakes Basin Fish Management Plan. It is also apparent that no salmonid fishery of any consequence can be successfully produced in the Great Lakes, except possibly Lake Erie, unless lamprey control is an integral part of the program.

It is impossible to separate lamprey control from the needs of an anadromous or salmonid sport fish program. Complete evaluation of the two projects should be carried out simultaneously. For this reason a joint anadromous sport fish -lamprey control evaluation project is desirable and much more efficient than separate projects. Such a project has been proposed by New York State under AFS - D-J funding.

The following information will indicate how the proposed joint project will be coordinated with present overall Great Lakes Basin, New York State and other fisheries programs.

GREAT LAKES COMMISSIONS

Most Great Lakes activities are coordinated through various international or interstate organizations. There are four major commissions responsible for general planning, supervision, and specific programming within the Great Lakes Region.

INTERNATIONAL JOINT COMMISSION (IJC)

This joint commission was established in 1909. Six members, three from the United States and three from Canada, are assigned respective offices in Ottawa and Washington. Two general categories of responsibility have been given to the IJC. Authority to approve or disapprove requests for use, dispersion, or obstruction of boundary waters on either side of the international boundary which would affect lakes levels or river flows. All of the Great Lakes and their connecting channels except Lake Michigan are considered boundary waters under the jurisdiction of the IJC.

Regulation of water levels is of extreme importance to any Great lakes fisheries management program. Of specific concern to the AFS - D-J study is the IJC's responsibility for controlling the operation of the St. Lawrence Seaway and Power Projects which determines the water levels of Lake Ontario and the outflow of the St. Lawrence River. The proposed AFS - D-J study will

provide specific recommendations to be presented to the IJC in relation to desirable levels within these waters for sound fish management.

The second major responsibility of the IJC is to investigate and make recommendations on specific problems along the common frontier which effect the boundary waters. Of major concern to the IJC is water pollution. Part of the AFS - D-J study will be the determination of subtle pollutants within various fish populations, pollution conditions in the tributary waters of Lake Erie and Lake Ontario, and other pollution problems within the Lakes' proper. Findings from the proposed study will provide data for specific recommendations to the IJC relating to the proper fish management of New York State's Great Lakes waters.

GREAT LAKES FISHERY COMMISSION (GLFC)

This international commission was formed in 1955. Four commissioners from both Canada and the United States make up the governing body. The primary responsibilities of the commission are to formulate and coordinate research programs in order to determine the requirements for providing maximum productivity of fish stocks common to the United States and Canada within the Great Lakes; to formulate and implement sea lamprey control programs in the Great Lakes; to advise cooperating agencies on fisheries plans and programs associated with the Great Lakes.

The Commission is assisted by an advisory committee for each lake. Individual lake committees formulate plans and proposals through the joint efforts of lake associated States, the Province of Ontario, and Federal agencies for Commission consideration. Evalutation of lamprey control in Lake Ontario and determining what is needed to provide anadromous salmonid and other salmonid sport fishing in New York - Ontario shared waters is of highest priority.

The Project Supervisor of the proposed AFS - D-J study, as Director of the Great Lakes Fisheries Research Station, coordinates Lakes Erie and Ontario Committee input with other States, Ontario, and the Commissioners. He is Chairman of New York State's Coho Salmon Committee, Chairman of the GLFC Lake Ontario Lamprey Control Sub-Committee and Chairman of the GLFC Lake Erie Coho Salmon Sub-Committee. The mandated responsibilities for the listed assignments will insure the closest coordination between the proposed AFS - D-J project and GLFC programs.

GREAT LAKES COMMISSION (GLC)

This interstate commission was established in 1955 and consists of three to five representatives from the eight Great Lakes States. There are five permanent committees and special appointed committees as required. The Fish and Wildlife Committee is of major concern to agencies responsible for fisheries management in the Great Lakes.

The Commission acts as a clearing house for important information through special publications. It is used as a counsel for common State problems in the Great Lakes and supports policies acceptable by the Great Lakes States that are in the public's interest. It also promotes the economic development of the Great Lakes Region, particularly through the Great Lakes St. Lawrence Seaway System.

Individual GLFC Lake Committee Plans and Programs are presented at the GLC meetings. Accepted programs receive GLC support. The proposed AFS - D-J study is closely aligned to goals endorsed by the GLC.

The GLC also has representatives on the Great Lakes Basin Commission and aids in forming a liaison between international - interstate commissions.

GREAT LAKES BASIN COMMISSION (GLBC)

The Great Lakes Basin Commission was created in 1967 with Commission members from the eight Great Lakes States, nine Federal agencies, and the Great Lakes Commission.

The primary purpose of this interstate commission is to coordinate governmental and non-governmental plans and development of water and related land resources use within the Great Lakes Basin. In conjunction with this responsibility a comprehensive coordinated joint plan for all governmental and non-governmental water users within the basin is being developed.

This commission is concerned with the entire Great Lakes Basin drainage. At the present time, a comprehensive coordinated framework study is being undertaken involving all water users. A fish-work group made up of representatives of State and Federal fisheries personnel involved in Great Lakes programming is developing an overall framework fisheries study plan for the Great Lakes Basin. The Director of the Great Lakes Fisheries Research Station at Cape Vincent is chairman of the Lake Ontario group and advisor to the Lake Erie group.

The proposed AFS - D-J project is closely linked to the proposed framework study in both lakes. The problems and needs of the tributary streams have been outlined within the sub-areas of the framework study. (Copies are attached). The GLBC Plan for Lake Ontario and Lake Erie will be completed in 1970 or early 1971. The proposed AFS - D-J project should provide many of the needs stated in the Great Lakes Basin Commission's Framework Study for proper fisheries management in New York State's Great Lakes waters.

It is obvious that no Great Lakes plan can be of real value if only part of the waters are involved. All fisheries programs in New York State's Great Lakes waters are coordinated with Canadian programs, primarily through the Great Lakes Fishery Commission, and various lake conferences and individual contacts. The Province of Ontario has been consulted on New York

State's proposed Great Lakes Basin Commission Framework Plan. The major objectives of the AFS - D-J study are in alignment with those proposed by the Province of Ontario.

OTHER GREAT LAKES ORIENTED ORGANIZATIONS OF INTEREST TO AFS-D-J PROJECT PERSONNEL

In addition to the four major commissions listed above, there are several other commissions or Great Lakes organizations that will be closely associated with the proposed AFS - D-J project. At present the Director of the Great Lakes Fisheries Research Station represents New York State at the International Association for Great Lakes Research (IAGLR) meetings. This organization was formed in 1967 to sponsor the Conference on Great Lakes Research.

The objectives of the IAGLR are the promotion of all aspects of Great Lakes research and the dissemination of resulting information through publications and meetings. The AFS - D-J programs and findings will be presented at the appropriate time to the association. Supplemental data available from other ongoing studies will be sought through IAGLR meetings and publications.

Lake Ontario has been chosen as the study water for the International Field Year for the Great Lakes (IFYGL). It is part of the World-Wide Hydrological Decade program. Intensive studies will start on Lake Ontario in 1971. The proposed AFS - D-J project will be closely linked to the ongoing IFYGL studies. Of particular importance will be the monitoring of fish stocks throughout Lake Ontario during the IFYGL year in order to relate fish populations with the various hydrolcgical, meteorlogical, and other studies that will take place. The Great Lakes Fishery Commission has supported the proposal that fisheries programs within Lake Ontario be oriented as closely as possible to the IFYGL studies. Personnel at the Cape Vincent Research Station, working with representatives from the Province of Ontario, B.S.F. & W. personnel and IFYGL Committee representatives, will develop a fish monitoring program for Lake Ontario associated with proposed IFYGL studies during 1971-72.

The Canadian Center for Inland Waters (C.C.I.W.) is a most comprehensive organization designed to determine existing limnological conditions and various problems and possible solutions on the Great Lakes and other freshwaters. Coordination between New York State's programming and C.C.I.W. will be an integral part of the Cape Vincent Station's operation whenever possible. The proposed AFS - D-J study will utilize C.C.I.W. findings pertinent to the goals of the project.

Through the GLFC, GLBC, and GLC, programs that are carried on at Cape Vincent Station and particularly the proposed AFS - D-J personnel will be coordinated with the various local,State and Federal agencies involved in New York State's Great Lakes waters. Of particular importance will be the

coordination of B.S.F. & W. activities in Lake Ontario and Lake Erie with the proposed AFS - D-J studies.

In addition to the organizations listed, project personnel will cooperate closely with the St. Lawrence River-Eastern Lake Ontario Commission. Formed in 1970 this New York State Commission is mandated to promote and protect the St. Lawrence River-Eastern Lake Ontario Region.

THE IMPORTANCE OF THE PROPOSED STUDY TO NEW YORK STATE'S FISH MANAGEMENT PROGRAM

One-third of the State's land area is in the Great Lakes Basin. All of the St. Lawrence River, Lake Ontario, Niagara River, and the best part of the eastern basin of Lake Erie within the United States are New York State waters. The need for a comprehensive fish management plan to provide sport and possibly commercial fishing for future generations is obvious. No long range State freshwater fish program can be complete unless the Great Lakes waters play a dominant role.

New York State is currently engaged in a statewide water resources planning program. Planning boards representing all segments of the public and advised by State and Federal personnel are formulating plans for future use of all State waters. The following boards are currently planning for all the State's Great Lakes waters.

Board:	Scheduled Completion Date
Erie-Niagara	1970
Oswego River Basin:	
Cayuga Lake	1972
Wa-Ont-Ya	1972
Eastern Oswego	1972
Genesee	1973
Black	1973
St. Lawrence *	1973

*(Includes Oswegatchie, Grasse, Raquette Rivers)

Since 1968 New York State has been carrying on a pilot experimental Pacific salmon stocking program in Lake Erie and Lake Ontario (see attached). The project has been coordinated with Ontario and other Great Lakes States primarily through the Great Lakes Fishery Commission. Unfortunately, evaluation of the stocking in open lake waters and most tributaries has been at a minimum due to lack of funds, equipment and personnel. The proposed

AFS - D-J study will encompass and expand the existing Pacific salmon program as well as include additional salmonid species.

State propagation facilities are at maximum production. An evaluation study is underway to determine the most efficient hatchery system for present and projected State stocking needs. Results of the AFS - D-J study will be of extreme value in determining propagation needs in this decade and through the year 2020.

Two federal aid orgoing studies at Cornell University, AFS-1, the artifical spawning channel study and experimental control of lampreys in Cayuga Lake Inlet as part of F-24-R will compliment the AFS - D-J project in the Great Lakes. Artificial spawning channels may be of great future importance to New York State's Anadromous Great Lakes program. Control of lampreys in certain streams through traps installed in fishways may be an important aspect of future lamprey control. Findings from F-24-R and the AFS - D-J project will determine what course management should take for future lamprey control in Great Lakes waters, other Finger Lakes, Lake Champlain, and Oneida Lake.

Smallmouth bass studies in eastern Lake Ontario - Upper St. Lawrence River have been carried on from the Cape Vincent Station since 1966. Results of the study are providing means of insuring a smallmouth bass fishery through proper management methods for future generations of anglers. The results of the AFS - D-J study coupled with proposals from warm water studies such as the State-funded smallmouth bass project will be the basis for future Great Lakes sport fish management in New York State.

The Aquarium and Conservation Education Room located at the Cape Vincent Station provides an ideal setting to inform the public about New York State's aquatic oriented problems and programs. Special emphasis is placed on teaching school children, scout groups, 4-H organizations, and other youth groups at the facility.

Easy access to local T.V., radio, and newspapers provides an excellent means of keeping the public informed on progress of studies such as the proposed AFS - D-J project. Considerable communication with the public will be desirable and a necessary part of any lamprey control program. The tremendous public interest in anadromous fish and lamprey control in New York State and Ontario makes it imperative that the public be kept well informed on the operations and results of any study.

COORDINATION WITH THE PROVINCE OF ONTARIO

All New York State proposals and programs associated with the Great Lakes are coordinated with the Province of Ontario. The GLFC is the primary official organization formal plans are coordinated through.

A sister Station similar to the Cape Vincent Station has been in operation in Canada since about 1950. Located at Picton, some 30 miles west

of Kingston in the Bay of Quinte area of Lake Ontario, it is only a short travel time from the Cape. An excellent informal relationship exists between the personnel at the two Stations. There is also an excellent relationship with other Ontario personnel in the various fisheries offices working on the Great Lakes. The goals of the proposed AFS - D-J project are whole heartedly supported by Canadian co-owners. The free exchange of data between the two agencies will be of considerable importance to the overall project.

CONCLUSION

It has been obvious to fishery scientists associated with the Great Lakes fisheries programs that lamprey control is of primary importance in providing a new fishery or bringing back lost fisheries in Lake Ontario.

It is also apparent that salmonid species, and particularly anadromous fish, offer the greatest potential for providing a good sport fishery.

It is also apparent that only through coordinated efforts on a Great Lakes Basin scale can such a sport fishery be produced in the most efficient manner.

The proposed study has been designed to augment New York State and the entire Great Lakes needs. It will be carried out in association with ongoing Great Lakes programs and proposed plans of the various Great Lakes organizations. When completed the findings from this study should materially benefit fisheries management of all Great Lakes waters, and provide plans for a major sport fishery throughout New York State's Great Lakes waters.

ORGANIZATIONS AND UNITS COORDINATED WITH PROPOSED AFS - D-J PROJECT

IJC	International Joint Commission
GLC	Great Lakes Commission (Interstate)
GLFC	Great Lakes Fishery Commission (International)
GLBC	Great Lakes Basin Commission (Interstate)
ST. L.R.-E.L.O.C.	St. Lawrence River-Eastern Lake Ontario Commission (Interstate)
IAGLR	International Associate for Great Lakes Research
IFYGL	International Field Year for the Great Lakes
GLFRS	Great Lakes Fisheries Research Station (State)

Fishery

APPENDIX E

Assessment and Projections of Sport Fishing in the Southern Portion of the Lake Ontario Basin

From GLBFS Appendix 8 Draft 1

PLANNING AREA 5.1

New York State is currently engaged in a statewide water resources planning program. Detailed fisheries plans for Area 5.1 will be included in the State Genesee Basin Plan scheduled for completion in 1973. Much of the data in this report was obtained from the Genesee Basin Plan files.

SPECIES COMPOSITION, RELATIVE IMPORTANCE AND STATUS

The waters comprising Planning Area 5.1 offer considerable variety in fish habitat and thus the number of important species present is large. Yellow perch, northern pike, walleye, smallmouth bass and largemouth bass are the most important warmwater species. Of somewhat lesser importance are chain pickerel, black crappie, rock bass, common sunfish, bluegill, carp, bullheads, catfish and suckers. Lake trout and rainbow trout occur in three lakes and provide moderately important fisheries.

The river and streams provide both warmwater and coldwater fisheries. Smallmouth bass, walleye, northern pike and rock bass are the principal warmwater species while the brown trout is the predominant coldwater fish. Brook trout and rainbow trout occur in a few streams.

Wiscoy Creek in Wyoming County and the upper Genesee River in Allegany County are considered among the top 50 trout streams in the State. Also Spring Creek in Monroe-Livingston Counties and

sections of Oatka Creek in Monroe County provide exceptionally high quality trout fishing.

There is good potential for the improvement or enhancement of many of the waters in Area 5.1 through pollution abatement, better access, stream improvement, special regulation, water level control and stocking.

HABITAT DISTRIBUTION AND QUANTITY

The natural lakes and ponds, reservoirs and farm ponds provide 13,967 acres of fishable water. The bulk of this acreage is located in the lower or northern portion of the basin (Figures 104 and 106). There is a need for addition lake type fisheries in the upper portion of the basin.

HABITAT PROBLEMS AFFECTING PRODUCTION AND DISTRIBUTION OF IMPORTANT FISH SPECIES

Water quality impairment by sewage, other nutrients, industrial wastes and pesticides is one of the most significant factors limiting the fishery potential of the waters. It occurs in all parts of the basin and affects both stream and lake environments. The effects of eutrophication are becoming more and more apparent in Conesus, Honeoye and Silver Lakes as well as in the bays along Lake Ontario. Destruction of stream trout by pesticides has been a problem adjacent to certain areas where potatoes are grown. Pollution effects in general are accentuated during periods of low flows.

The high intensity of use for boating and the development of shore lines on the larger lakes is a problem. It is difficult to fish some of the lakes during daytime hours, especially on weekends, due to boating and water skiing. Much fish spawning habitat has been

destroyed by filling for cottage development.

Drawdown and water level regulation are problems on some of the lakes. Yearly fluctuations in water level as great as 65 feet occur as water stored in Rushford Lake is released to help maintain the volume of the Genesee River for the generation of power. Lowering of water levels after northern pike spawning in the spring of the year has been a problem on Silver and Conesus Lakes.

Destruction of trout stream habitat through gravel removal and channel dredging is a problem although it has been brought under control recently by the implementation of Section 429 of the Conservation Law (Stream Protection Law). Irrigation is a growing threat to some of the trout stream resources of the basin. The reduction of flows during low water periods may become critical for trout survival or seriously interfere with the production of these fish.

Flooding which results in the erosion of stream banks is common to most streams in the basin. Protection of trout-stream habitat from serious erosion is a continual problem.

FIGURE 103

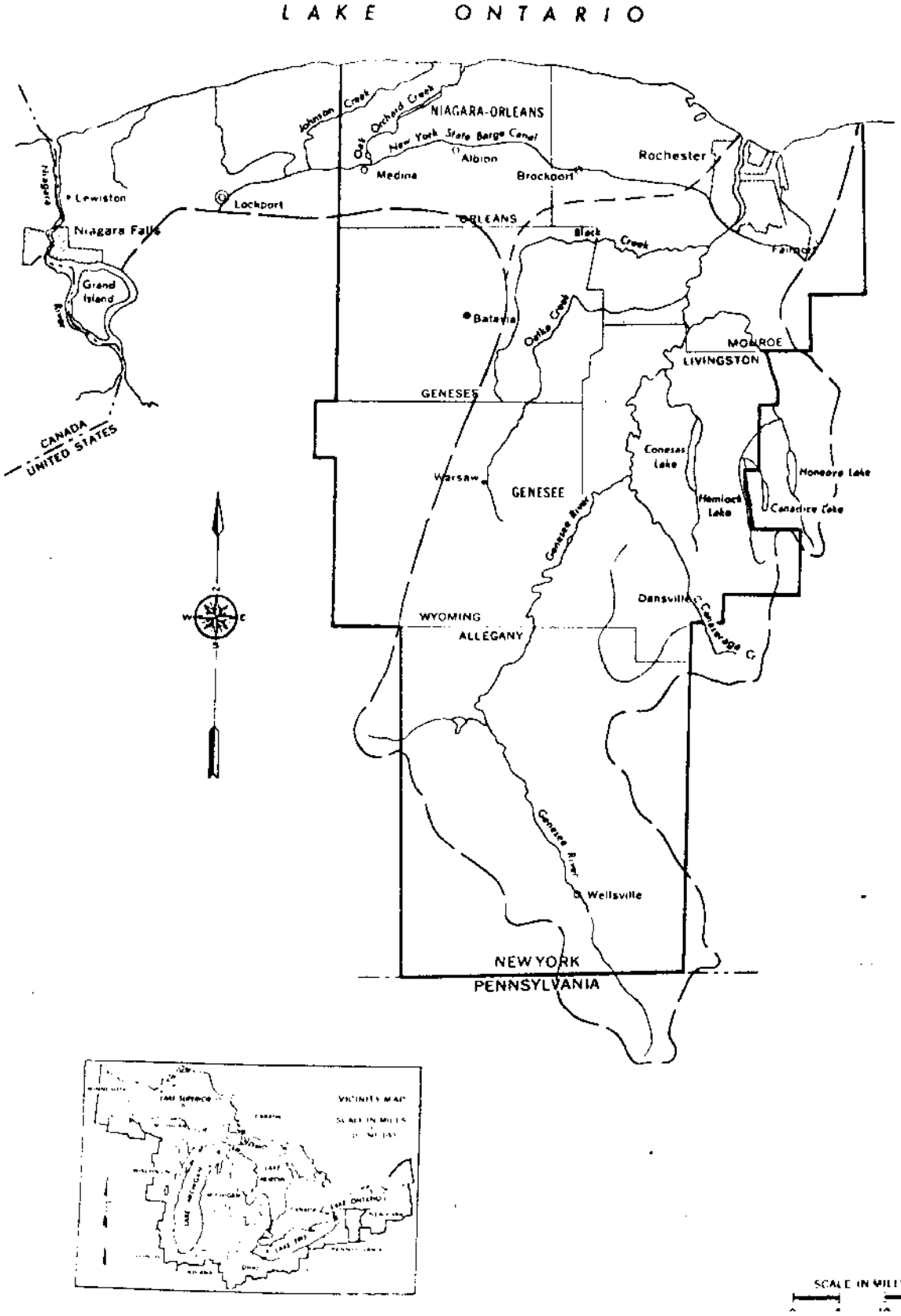
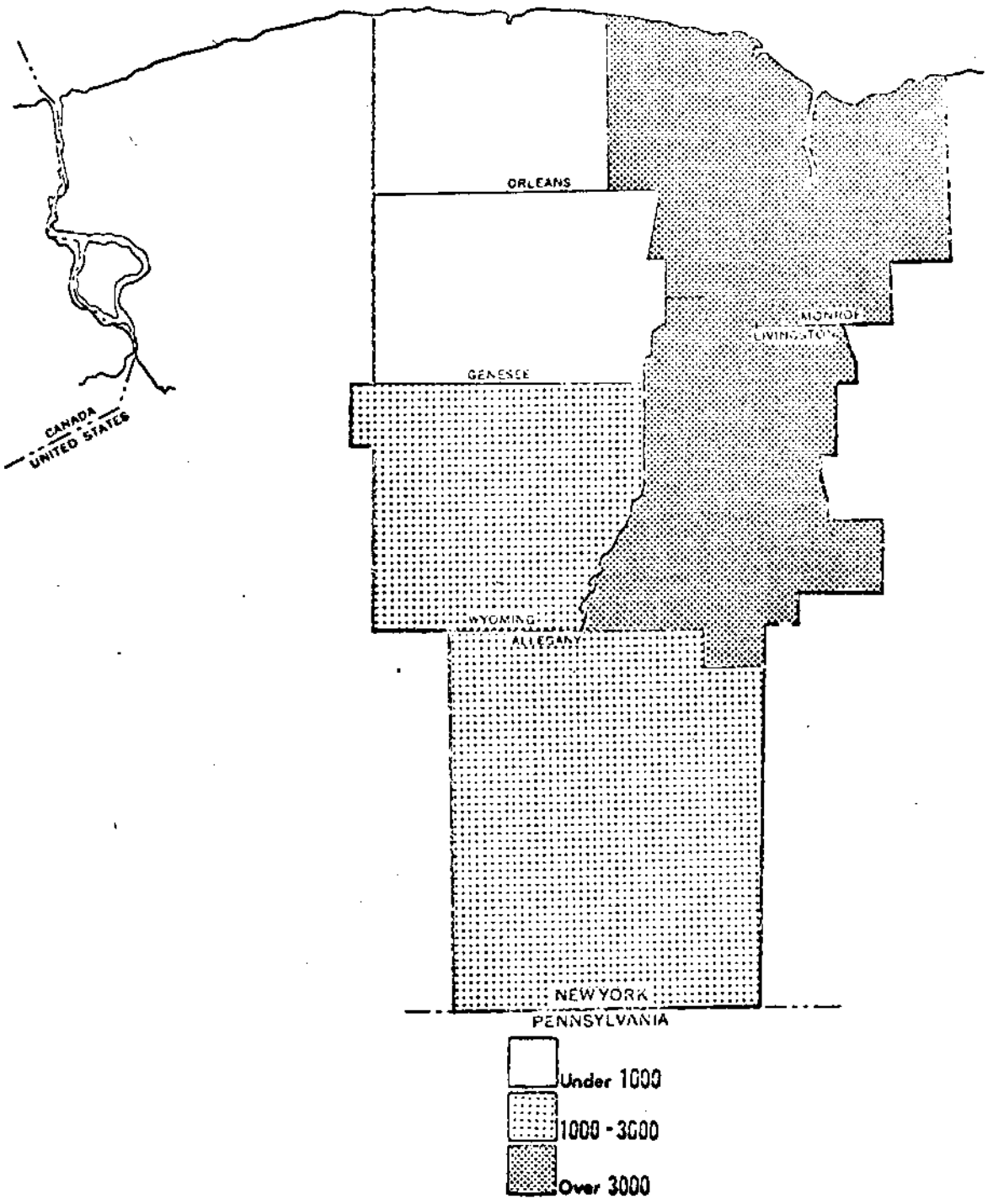

LAKE ONTARIO
Johnson Creek
Orchard Creek
NIAGARA-ORLEANS
New York State Barge Canal
Albion
Rochester
Medina
Brockport
Lockport
ORLEANS
Black Creek
Fairport
Lewiston
Niagara Falls
Grand Island
Batavia
Oatka Creek
MONROE
LIVINGSTON
GENESEE
CANADA
UNITED STATES
Conesus Lake
Honeoye Lake
Warsaw
GENESEE
Hemlock Lake
Canadice Lake
Genesee River
Dansville
WYOMING
ALLEGANY
Canaseraga Cr.
Genesee River
Wellsville
NEW YORK
PENNSYLVANIA
VICINITY MAP
SCALE IN MILES
SCALE IN MILES

Figure 104

ACRES OF PONDED WATER



and Management Efforts in Area 5.1

County	Total Area Sq. Miles	Acres[2/] Ponded Waters	Number[2/] Ponded Waters	Number Intensively Managed	Acres Intensive Warm water	Acres Intensive Trout	Miles Total Streams	Miles Trout Streams
Allegany	1048	1038	310	4	None	631	116	83
Wyoming	598	1005	236	3	815	2	80	65
Livingston	638	5355	461	4	3251	1858	178	75
Genesee	501	206	116	1	47	None	32	8
Monroe	673	3306	317	2	2055	None	112	13
Orleans	396	766	642	1	None	335	40	None
Ontario [1/]	-	2291	2	2	1670	621	6	-
Total	3854	13,967	2084	17	7838	3447	564	244

1/ Only Honeoye Lake and Canadice Lake in Genesee Watershed are included.

2/ Includes Farm Ponds.

Figure 110

Sub Area 5.1

NEW YORK

Counties	Land Area Sq.Mi.	Population 1,000s	Ponded Waters Acres	Res. Fish Licenses	Non-Res. Fish Licenses	Res. Licenses Per Capita	Ponded Waters Per Capita
Allegany	1,043	43.9	1,293	4,909	337	.1118	.0295
Genesee	500	59.8	196	5,033	22	.0842	.0033
Livingston	636	50.5	5,186	4,904	72	.0971	.1027
Monroe	673	655.6	3,366	52,443	566	.0800	.0051
Orleans	394	37.7	.556	4,474	26	.1187	.0147
Wyoming	595	37.6	1,266	3,857	74	.1026	.0337
TOTAL	3,841	885.1	11,863	75,620	1,097	.0854	.0134

Projections			Total Angler Days
1980	3,841	978.2	2,488,605
2000	3,841	1,221.8	3,108,340
2020	3,841	1,538.0	3,912,774

From Great Lakes Basin Framework Study No. 8
Fish Appendix (1971)

PLANNING AREA 5.2

New York State is currently engaged in a statewide water resources planning program. Detailed fisheries plans for Area 5.2 will be included in the State Oswego River Basin Plan scheduled for completion in 1972. Much of the data included in this report was obtained from the Genesee Basin Plan files.

SPECIES COMPOSITION, RELATIVE IMPORTANCE AND STATUS

The waters comprising Planning Area 5.2 are complex. They offer an excellent variety and abundance of fish habitat and consequently the number of important sport species is large. This presents a problem in determining the most important species on a priority basis.

Lake and rainbow trout are extremely valuable sport fish species in the Finger Lakes. Brown, brook, and rainbow are of considerable importance to the trout stream fishery and to a lesser degree in ponded waters. Atlantic salmon have provided good limited angling in the Finger Lakes when suitable smolt stock has been available. Kokanee salmon have been successfully stocked in a few waters but are of minor importance to date. Coho salmon stocking by New York since 1968 and the Province of Ontario since 1969 in Lake Ontario tributaries has provided some angling and holds considerable promise for the future if sea lamprey control proposed for Lake Ontario in 1971-72 is successful. Resident strain rainbow and west coast strain steelhead

may provide excellent angling if lamprey control is a success. Dipping for smelt during spawning time is a major fishery in many of Lake Ontario's tributaries as well as some Finger Lakes streams.

Smallmouth bass, walleye and northern pike are very important in the rivers and ponded waters throughout the area. Largemouth bass and chain pickerel (Esox niger) are of moderate importance as game fish.

Panfish such as yellow perch, rock bass, sunfish, bullheads, crappies and white perch are of great importance in the order listed. Channel catfish, suckers, carp and eels are of minor importance in the overall sport fishery. The abundance of alewives, particularly in some Finger Lakes, is of extreme importance as a forage species for large salmonids.

Until recently, several species of minnows were of great commercial value to bait dealers. Bait farms in other states have relegated native bait minnows to minor importance except to a few localized bait dealers.

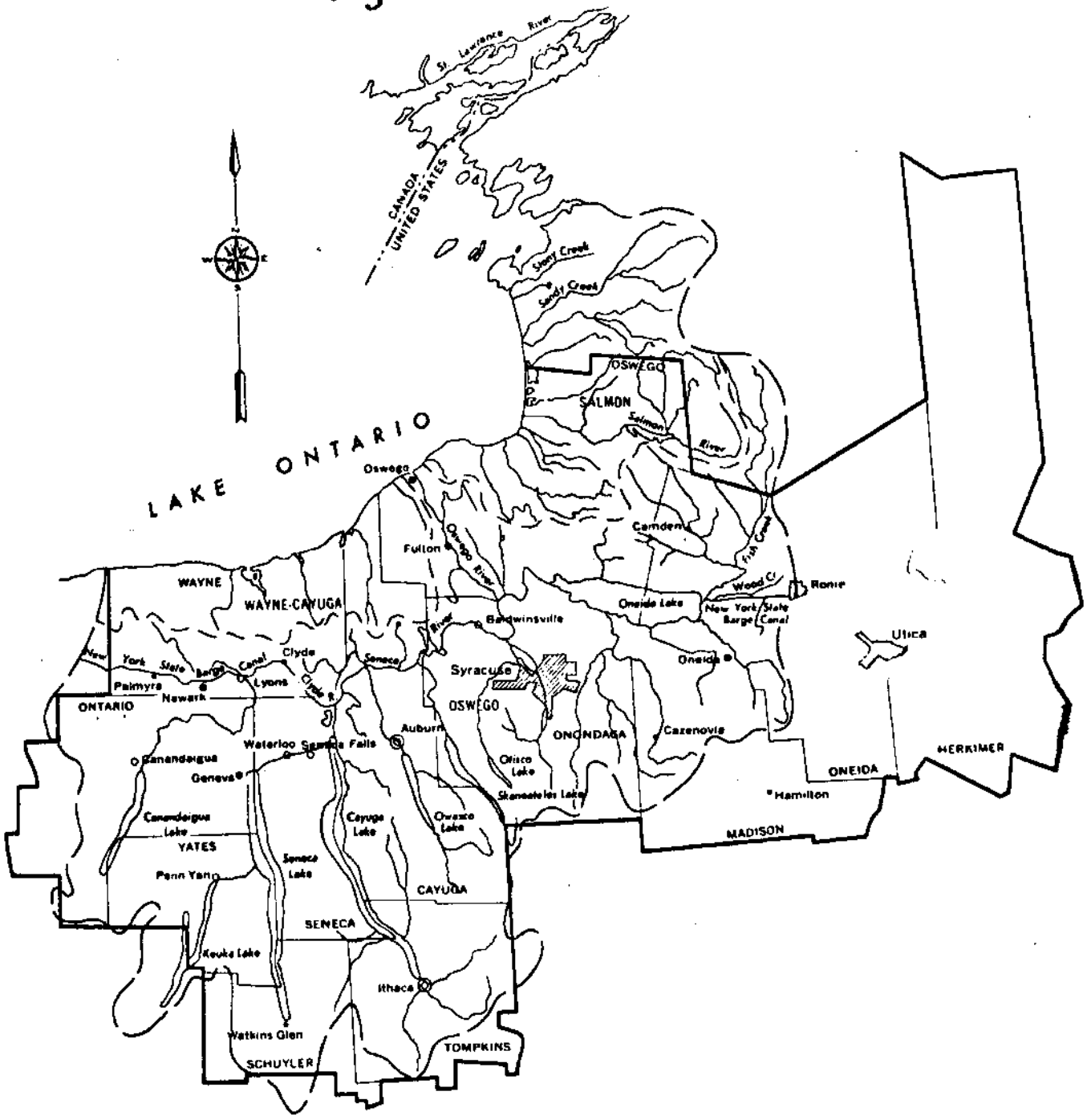
A small commercial set line fishery exists in Oneida Lake as well as carp seining under special permits in a few area waters.

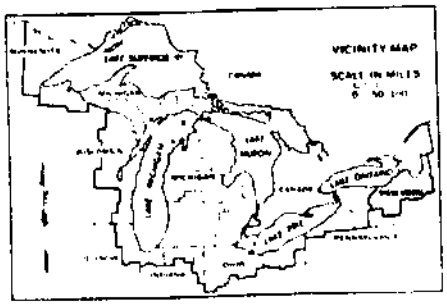
Although not a true fish, sea lampreys are present in Cayuga and Seneca lakes as well as Oneida Lake. Their presence has an effect on the abundance of various associated species.

HABITAT DISTRIBUTION AND QUANTITY

Area 5.2 was blessed with an abundance of good fishable waters, particularly in Seneca, Cayuga, Oswego and Oneida counties. (Figure #3). Except for the lack of brook trout ponds, waters within the area with proper management and controls should supply existing and latent anglers needs through 1980. The potential for the construction of

Figure 112





SCALE IN MILES
0 5 10 15 20

FIGURE 113

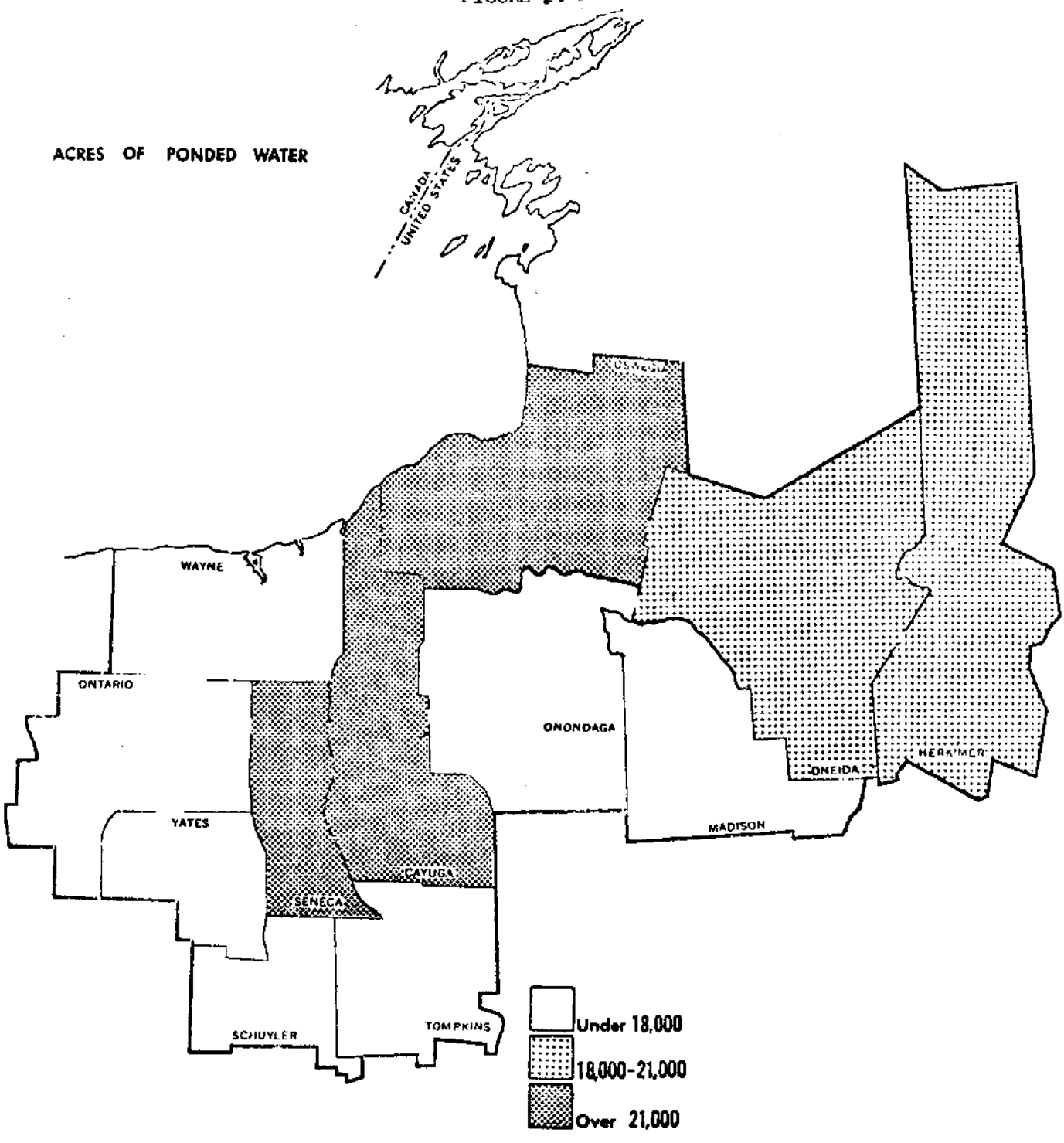

ACRES OF PONDED WATER
CANADA
UNITED STATES
WAYNE
ONTARIO
YATES
SENECA
CAYUGA
ONONDAGA
ONEIDA
HERKIMER
MADISON
SCHUYLER
TOMPKINS
Under 18,000
18,000-21,000
Over 21,000

FIGURE 114

Principal Rivers and Streams - Area 5.2

Region 1/	Trout		Warm-water	
	Miles	Acres	Miles	Acres
I	63	103	146	1,658
II	49	61	2	15
III	507	800	157	2,570
IV	562	854	66	2,988
Basin Totals	1,181	1,818	371	7,211

1/ N.Y.S. Dept. Environmental Conservation Regional Fish & Wildlife

Region 1 - Counties of Wayne, Ontario, Yates, Seneca

Region 2 - Counties of Steuben, Schuyler, Chemung

Region 3 - Counties of Cayuga, Tompkins, Onondaga, Cortland, Mad

Region 4 - Counties of Oswego, Oneida, Lewis

FIGURE 115

MORPHOMETRIC DATA - LARGER LAKES - AREA 5.2

LAKE	Area (Acres & s q. miles)	Drainage Area (sq. miles)	Max. depth (feet),	Mean depth (feet)	Shoal Area to 20' (acres)	Percentage Lake Area in shoals	Max. length (miles)	Max. width (miles)
Canandaigua	11,456 (17.9)	189	274	127	1,922	16.8%	15.5	1.5
Seneca	43,264 (67.6)	714	633	289.6	5,591	12.9%	35.1	3.0
Cayuga	42,816 (66.9)	780	435	178.8	10,906	25.5%	38.1	3.5
Keuka	11,584 (18.1)	179	183	99	1,209	10.4%	19.6	1.9
Owasco	6,592 (10.3)	208	177	95	1,028	15.6%	11.1	1.25
Skaneateles	8,896 (13.9)	73	297	142.7	1,444	16.2%	15.0	1.4
Otisco	1,856 (2.9)	34	70	--	946	50.9%	5.8	0.8
Onondaga	3,040 (4.75)	240	73	--	762	25.1%	4.6	1.2
Oneida	51.072 (79.8)	1265	55	25	19,890	38.9%	20.8	5.5
Cross	2,176 (3.40)	--	64	--	1,062	48.8%	4.5	1.0
Cazenovia	1,100 (1.72)	10	48	--	588	53.5%	3.7	0.7

Figure 119

Sub Area 5.2

NEW YORK

Counties	Land Area Sq.Mi.	Popu-lation 1 000s	Ponded Waters Acres	Res. Fish Licenses	Non-Res. Fish Licenses	Res. Licenses Per Capita	Ponded Waters Per Capita
Cayuga	696	75.1	25,646	8,729	180	.1162	.3415
Herkimer	1,416	67.7	19,429	8,084	333	.1194	.2870
Madison	660	57.6	1,207	8,303	197	.1441	.0210
Oneida	1,218	282.0	20,689	28,633	308	.1015	.0734
Onondaga	790	457.8	14,854	45,554	488	.0995	.0324
Ontario	648	76.6	10,651	9,638	284	.1258	.1390
Oswego	964	96.4	32,439	14,622	248	.1517	.3365
Schuyler	329	16.7	7,074	3,077	514	.1843	.4236
Seneca	329	33.8	56,934	4,633	295	.1371	1.6844
Tompkins	481	74.7	9,281	7,525	216	.1007	.1242
Wayne	606	74.2	4,917	10,762	151	.1450	.0663
Yates	343	19.5	8,828	3,101	296	.1590	.4527
TOTAL	8,480	1,332.1	211,949	152,661	3,510	.1146	.1591

Projections			Total Angler Days
1980	8,480	1,571.7	**5,395,940**
2000	8,480	2,015.9	**6,920,961**
2020	8,480	2,556.5	**8,776,942**

PLANNING AREA 5.3

New York State is currently engaged in a statewide water resources planning program. Detailed fisheries plans and needs for Area 5.3 will be covered in the St. Lawrence River Basin Plan which includes the Oswegatchie, Grasse, and Raquette rivers. The plan is scheduled for completion in 1973.

SPECIES COMPOSITION, RELATIVE IMPORTANCE AND STATUS

Due to the variation in habitat from mountain to low level lake basin types, Area 5.3 supports a large number of fish species. Coldwater species such as brook, brown, rainbow, and lake trout are very important in the order listed. Splake (lake trout-brook trout hybrid) have shown promise in a few waters. Atlantic salmon smolt stockings have been very successful in a few Adirondack lakes when stock has been available. Kokanee hold some promise on a limited basis. Coho, chinook, and rainbow spawning run fishing has great potential if the Lake Ontario anadromous fish program in conjunction with lamprey control is successful. Lake whitefish and round whitefish, once abundant, are nearly gone in the area. In recent years smelt dipping has become a major spring fishery in several waters.

Warmwater species provide more angling in the area than salmonids. Smallmouth bass, northern pike, walleye, largemouth bass, muskellunge, and chain pickerel are important game species in the order listed.

Panfish are of great importance and probably support more angling than game fish species. Yellow perch, bullheads, sunfish, rock bass, crappies, suckers, and catfish are important in the order listed. Carp are abundant below natural barriers but absent from Adirondack waters. Round whitefish (Prosopium cylindraceum), lake whitefish (Coregonus clupeaformis), landlocked salmon (Quananiche), (Salmo salar sebago), lake sturgeon (Acipenser fulvescens), and lake chub (Couesius plumbeus) can be considered at or near the endangered native species level in Area 5.3.

HABITAT DISTRIBUTION AND QUANTITY

Four major river systems, Black, Oswegatchie, Grasse, and Raquette, provide a myriad of Adirondack ponds, lakes and streams in their upper reaches. Below the mountain elevations, all provide a considerable amount of good to fair warmwater stream and pond habitat. In addition, a series of large warmwater ponds (Big Sandy, South Sandy, Lakeview) are located west of Salmon River just south of Lake Ontario. (Figure 23 and 24). Associated with these ponds and all major Lake Ontario tributaries are extremely important marshes. (Figure 23).

Area 5.3 fishable waters, excluding marshes and farm ponds, include: approximately 31,000 acres of ponded coldwater; 28,250 acres of ponded warmwater; 2,360 miles of coldwater streams, 721 miles of warmwater streams. Much of the designated coldwater habitat also supports warmwater species.

There is a need for ponded trout waters in most of the section outside of the Adirondack Mountains. Except for this need, Area 5.3 is capable of supporting present and projected angling demand through 1980. If habitat improvement and intensive management practices are

Figure 101


CANADA
UNITED STATES
St. Lawrence River
Ogdensburg
Grass River
Potsdam
Canton
Raquette River
St. Regis River
West Branch
GRASS
RAQUETTE-ST. REGIS
Black Lake
Oswegatchie River
Gouverneur
Tupper Lake
Cranberry Lake
OSWEGATCHIE
ST LAWRENCE
PERCH
Indian River
Watertown
Black River
Carthage
Beaver River
Deer River
Lowville
Stillwater Reservoir
Raquette Lake
Fulton Lakes
BLACK
LAKE
ONTARIO
JEFFERSON
Moose
Black River
LEWIS

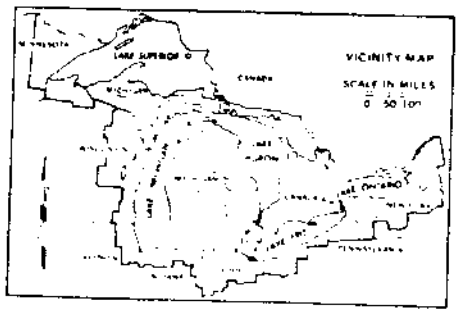

VICINITY MAP
SCALE IN MILES
0 50 100

FIGURE 124

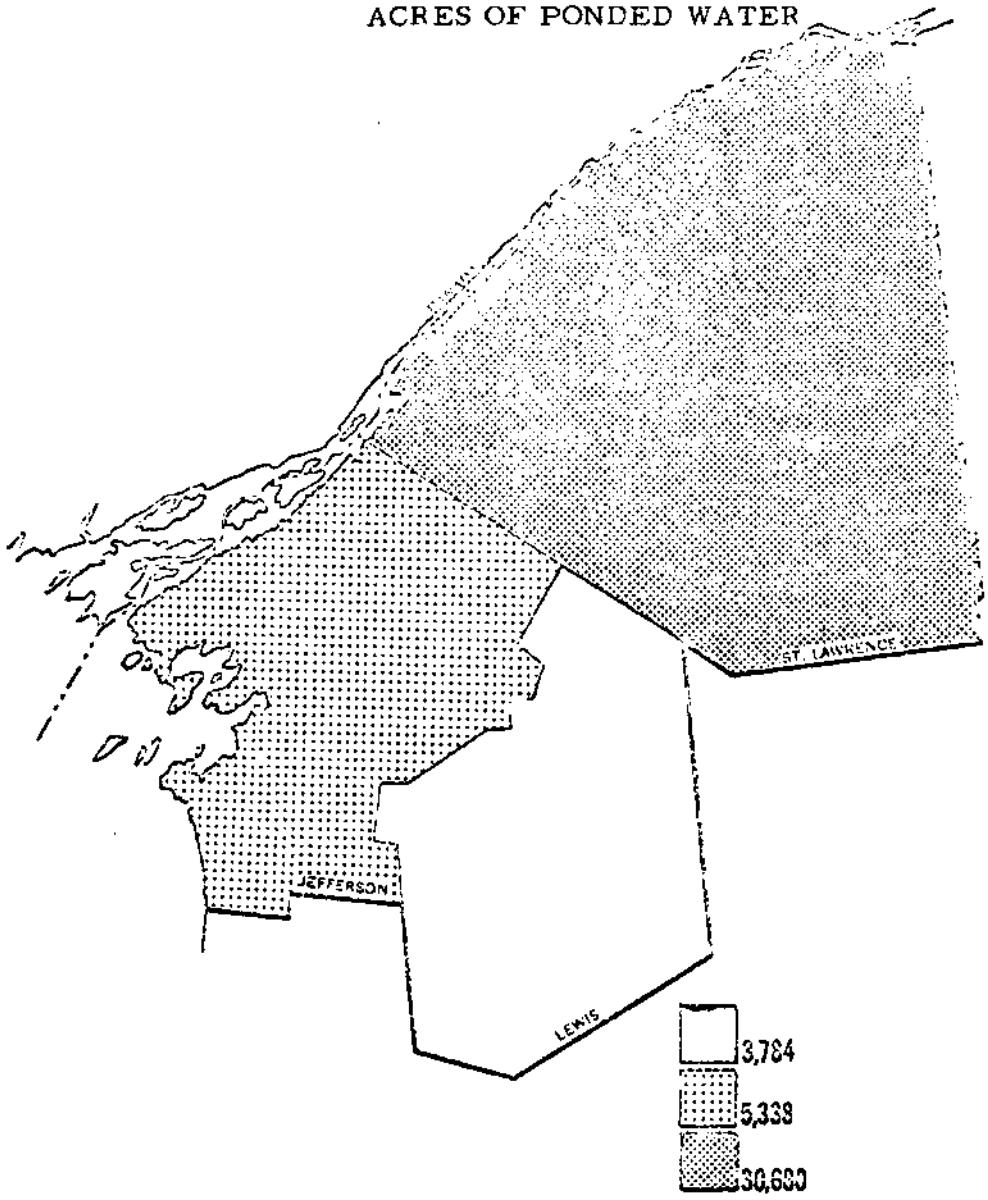

ACRES OF PONDED WATER
ST. LAWRENCE
JEFFERSON
LEWIS
3,784
5,338
30,680

FIGURE 122

FISHING WATERS WITHIN AREA 5.3

Watershed	Acres Ponded Cold Water	Acres Ponded Warm Water	Miles Cold Water Streams	Miles Warm Water Streams
Black River	18,143	1,223	1,113	116
St. Lawrence River *	9,319	24,152	1,119	575
Lake Ontario	3,506	3,865	396	30
Totals	30,968	29,240	2,628	721

* Includes Oswegatchie, Grasse, Raquette Rivers.

FIGURE 123

AREA 5.3 WETLANDS AT MOUTHS OF TRIBUTARIES
TO ST. LAWRENCE RIVER AND LAKE ONTARIO

Watershed	County	Acreage
St. Lawrence River	St. Lawrence *	3,002
	Jefferson	1,200
Lake Ontario	Jefferson **	3,452
	Oswego	1,584

* Includes State owned 1675 acre Wilson Hill Marsh.

** Includes State owned 2000 acre Lakeview Marsh.

Figure 125

Sub Area 5.3

NEW YORK

Counties	Land Area Sq.Mi.	Population 1,000s	Ponded Waters Acres	Res. Fish Licenses	Non-Res. Fish Licenses	Res. Licenses Per Capita	Ponded Waters Per Capita	Pop./ Sq.Mi.
Jefferson	1,292	89.8	5,338	22,432	1,874	.2498	.0594	69.5
Lewis	1,287	24.9	3,784	3,230	77	.1297	.1520	19.3
St. Lawrence	2,711	113.1	30,680	17,990	1,280	.1591	.2713	41.7
TOTAL	5,290	227.8	39,802	43,652	3,231	.1916	.1747	43.1
Projections				**Total Angler Days**				
1980	5,290	225.7		**1,339,703**				42.7
2000	5,290	257.2		**1,526,680**				48.6
2020	5,290	298.6		**1,772,420**				56.4

Fishery

APPENDIX F

Summary of the Fishery Resource of Lake Ontario by U.S. F.W.S. 1969

SUMMARY

On the basis of a framework-type analysis appropriate for this report, the following conclusions are drawn concerning the present and future status of the Lake Ontario fishery in relation to water quality:

1. Over the period of record the Lake Ontario commercial fishery (United States and Canada combined) has always had the lowest production of any of the Great Lakes.

2. Stocks of the higher value species such as lake trout, whitefish, lake herring, blue pike, white perch, and walleye have declined, in some cases to the point of commercial, if not biological, extinction. The United States fishery now depends heavily on carp, yellow perch, white perch, bullheads, and eels. Stocks of alewife and smelt are moderately abundant, with the latter being utilized extensively in the Canadian but not the United States fishery.

3. Less is known of the Lake Ontario fishery and its environment than that of any of the other Great Lakes. Consequently, analysis and explanation of its fish population dynamics is correspondingly difficult. Clear-cut turning points, such as the sea lamprey invasion and introduction of the alewife which serve as convenient bench marks for tracing major changes in the fishery dynamics of the other Great Lakes, are generally not applicable in Lake Ontario. The sea lamprey has always been present in Lake Ontario, while the alewife has been present in the lake, at least since 1890.

4. There have been three introductions to the Lake Ontario species complex. These are the carp (before the turn of the century; the smelt (1930's); and the white perch (1950's). There is some speculation that proliferation of the introduced smelt may be correlated with the decline of the blue pike, but not enough is known to reach a definitive conclusion.

5. Spawning areas for lake trout and whitefish are concentrated in the eastern end of the lake, primarily in Canadian waters. This lack of diversified spawning sites is in contrast to the situation prevailing in the Upper Lakes and has made the fish stocks particularly vulnerable to seasonal over-fishing. This vulnerability is increased by the tenuous nature of the balance that historically prevailed between the sea lamprey and its prey species. This concentration of limited spawning areas may also be a factor in the case of other species.

6. Re-establishment of a balanced predator-prey relationship in Lake Ontario is essential to achieving a stable and productive resource base. It is generally agreed that sea lamprey control will have to be initiated eventually in Lake Ontario, despite the special problems involved. Introduction of salmonid predators is already under way in both New York and Ontario. Careful monitoring of the fishery base will be necessary as these activities proceed, in order to determine the nature of the changes that occur and to indicate any possible adjustments which may be necessary in management procedures.

7. The overall low productivity of the total fishing resource in Lake Ontario is difficult to account for on the basis of knowledge currently available. Much more research and study will be required.

8. The combined United States-Canadian commercial fishery in Lake Ontario has demonstrated overall decline, with this decline particularly apparent to the United States segment. Greatest annual catches were taken prior to the turn of the century, followed by stabilization between three and four million pounds until the mid-forties. Subsequently, there has been a further decline, dipping below two million pounds in recent years.

9. Initially, United States and Canadian production was roughly equal. Presently, only 10 percent of the total harvest is taken by the United States fishermen and more than half of this comes from Chaumont Bay. Numbers of United States fishermen have dropped from over a hundred regular fishermen in the 1930's to a current level of one full-time and two part-time fishermen in the lake proper, plus 10 part-time fishermen in Chaumont Bay.

10. A number of factors have contributed to the present condition of the industry. Decline in abundance of the more valuable species (lake trout, whitefish, lake herring, and walleye) was of major importance. Fluctuations in the resource base have increased the uncertainty associated with commercial fishing in the United States, thereby limiting the desirability of investment in the fishery. Limited demand for the lower-valued species

currently available has been a further depressant. Increased cost of labor and materials further depresses expansion of the commercial fishery.

The inability or unwillingness of the United States fishermen to alter traditional methods of processing and marketing has led to a loss of competitiveness in the changing fishery products market. Restrictive and outmoded regulations have also played a part.

11. The Canadian fishery is better located with respect to the most productive fishing grounds, has operated under what is essentially a limited entry situation, has made more use of modern harvesting methods, and in general has developed a higher level of processing and marketing technology.

12. Many of the problems of the Lake Ontario commercial fishery are common to the overall Great Lakes fishery. Solutions to the problems are likely to be related to overall progress and development throughout the Great Lakes. This would include advances in harvesting and processing technology. It should become more responsive to changing consumer demand, market development, and reorganization of the fishery to fit the concept of balanced utilization of the total fishery resource. This includes a mutually supportive role between the sport and commercial fisheries. In this context, development of outlets for the large supplies of low value fish in Lake Erie (e.g., a fish meal plant) might simultaneously enable the Lake Ontario fishery to contribute on a scale commensurate with its lower productivity.

13. Potential demand for commercial fishery products from the Great Lakes is estimated to increase by more than fourfold by the year 2020. Even with the advances in harvesting, processing and marketing indicated in this report and development of data necessary for effective management systems, water quality is likely to become a constraint to meeting future demands.

14. From the commercial fishing standpoint, Lake Ontario is the least productive of the Great Lakes. In the other Great Lakes, commercial fishing productivity can be roughly correlated with the basic fertility of the environment. This correlation is much more difficult to demonstrate in Lake Ontario.

15. Except in the vicinity of major urban concentrations, Lake Ontario's inshore waters do not exhibit obvious signs of water quality degradation. However, the rapid proliferation of Cladophora since the 1950's is evidence of accelerated enrichment of these inshore waters. Oil pollution, originating from vessels is a serious problem.

16. Water quality is still high in the open waters of Lake Ontario, although there has been change. Concentrations of total dissolved solids have increased at an accelerated rate since 1910, paralleling the increases that have taken place in Lake Erie. Lake Ontario concentrations are slightly higher than Lake Erie, due to the addition of inputs from its own basin to the waters it receives from Lake Erie.

17. Despite higher concentrations of various dissolved solids than occur in Lake Erie, the open water of Lake Ontario has not developed comparable worsening of environmental conditions. Concentrations of dissolved oxygen are generally high, except for a few localities in the eastern end of the lake. Benthic fauna flourishes throughout the lake. The morphometry of Lake Ontario and its comparatively low road of suspended solids probably contribute to the failure to develop adverse conditions comparable to Lake Erie.

18. Preliminary investigations indicate that concentrations of pesticides such as DDT and dieldrin in fish do not follow the Lake Erie pattern. These substances are present in almost negligible concentrations in Lake Erie fish, whereas Lake Ontario concentrations are roughly equivalent to those of Lake Huron. This indicates buildup from within the Lake Ontario Basin itself to levels only one-half to one-third lower than measured in Lake Michigan fish. From the fisheries standpoint, this aspect of water quality demands the most immediate remedial action.

19. Although water quality changes to date throughout the Lake Ontario ecosystem have not proceeded to a point resulting in demonstrable adverse effects in fish and wildlife resources, the changes that have taken place should be viewed seriously. They are indicators that steps should be taken without delay to slow down, and eventually halt, inputs of pollution. The pollution control plan, as outlined in this Federal Water Pollution Control Administration report, should be implemented as a necessary first step.

20. As a result of the 1965 Water Quality Act, New York has improved their water quality standards. Under provisions of the Act, the Secretary of the Interior has approved all but the temperature and mixing zones standards proposed by New York. In this important respect these standards must be considered interim in nature. A great deal has yet to be learned about adequate aquatic life criteria and additional research may demonstrate the need for redefinition and refinement of the standards to meet fish and wildlife requirements. In the meantime, it is apparent that existing water quality over most of Lake Ontario's open waters exceeds the standards, for most if not all parameters. Until careful research demonstrates beyond a reasonable doubt that degradation of existing water quality to the level of the standards will not result in harmful effects upon fish and aquatic life resources, it is the position of the Bureaus of Commercial Fisheries and Sport Fisheries and Wildlife that the goal of pollution abatement in Lake Ontario should be retention or enhancement of the existing overall high quality of its waters.

21. Because of the special relationship of fish, wildlife, and aquatic organisms to long-term changes in water quality and the responsibility of State and Federal fishery agencies to increasing man's control of aquatic living resources and their environment, research on long-range environmental changes should be conducted by these agencies and coordinated through established institutions such as the Great Lakes Fishery Commission, with the help and cooperation of private and educational groups.

Recreation

APPENDIX A

Extracted From Great Lakes Basin Framework Study # 21
Outdoor Recreation, 1971

This study was prepared at field level and presents a framework program for the development and management of the water and related land resources of the U.S. portion of the Great Lakes Basin. Regions are broken down by SMSA units to five main regions (Figure 1). The predicted recreation requirements up to 2020 for each subarea around southern Lake Ontario are presented in Table 1. Potential programs to meet future requirements are described in a broad over-view designating specific areas for development. The four subregions with respective potential plans are:

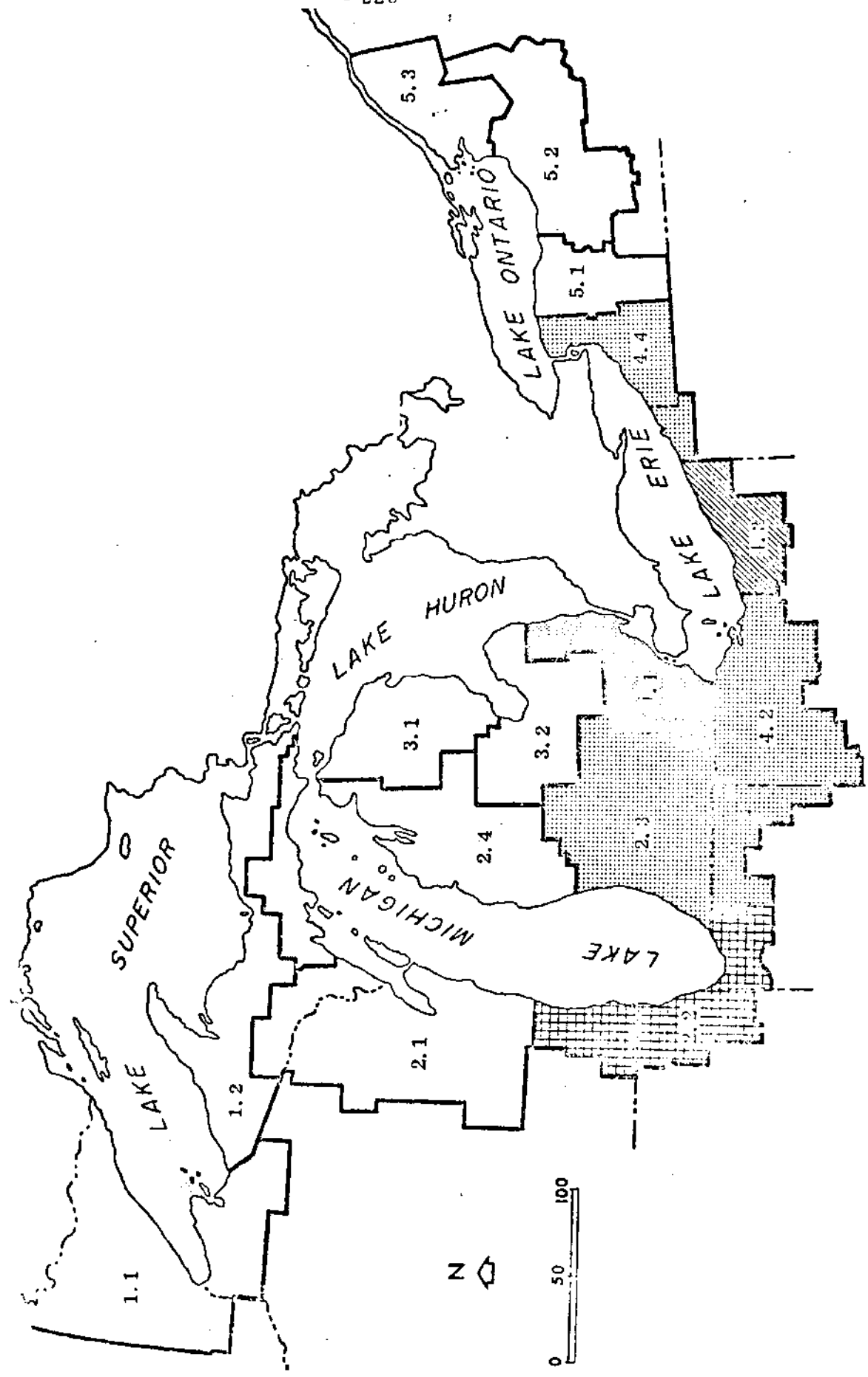
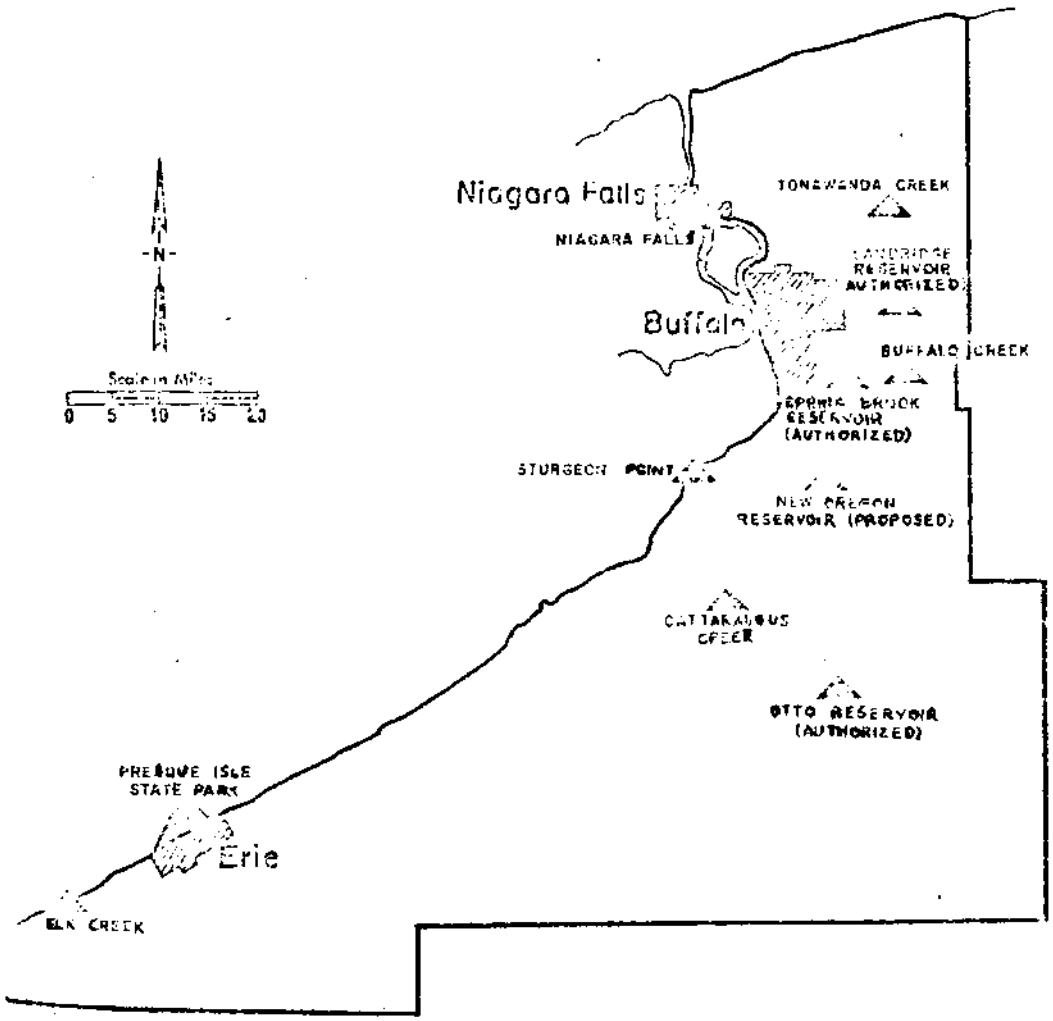


Figure 1. Selected Subregions of the U.S. Portion of the Great Lakes Basin

Subregion 4.4



Potential Programs to Satisfy Needs Subregion 4.4

A significant amount of potential supply exists within the subarea. This supply consists of a number of reservoir sites and areas that, if developed, could eventually provide recreational opportunities at

strategic locations for large numbers of people. There is one authorized Corps of Engineers reservoir in this subarea. The reservoir and several others are included in the Comprehensive Water Resources Plan (18) developed by the Erie-Niagara Water Resources Board. Sandridge Reservoir, the authorized Corps project, is located due east of Buffalo on Ellicott Creek. The surface area of the conservation pool would be 2,150 acres. The primary purposes would be flood control, low-flow augmentation, and recreation.

There are also several proposed reservoirs in this subarea. Spring Brook Reservoir, located southeast of Buffalo on Cazanovia Creek, would have a conservation pool surface area of 1,750 acres. The primary purposes would include flood control, low-flow augmentation, and recreation. Otto Reservoir would be located on the South Branch of Cattaraugus Creek and have a conservation pool of 4,450 acres. It would provide limited flood reduction, water quality, and recreation benefits. Several proposed small reservoirs are also set forth in the plan developed by the Erie-Niagara Water Resources Board. New Oregon and Thatcher Reservoirs would provide significant recreation benefits.

Other major potential areas include floodplains, especially those near urban areas, and state forests. The floodplains of Tonawanda Creek, Buffalo Creek, and Cattaraugus Creek offer substantial potential for recreational development and use. The floodplains of numerous smaller streams also offer significant potential for development.

The Pennsylvania Game Commission is currently considering acquisition of approximately 140 acres of land in Erie County. This will be maintained and used solely for hunting purposes.

The Pennsylvania Department of Environmental Resources is aware of some potential recreation site within the basin. This site is located along Elk Creek where it feeds into Lake Erie. The area has the potential for day-use activities and marina facilities.

A state park is also proposed at Sturgeon Point on Lake Erie in New York State. It would include about 435 acres of land with two miles of lakefront.

The North Country Trail may eventually pass through the subarea. This trail, plus any spur trails that may be developed, would help satisfy some of the needs for hiking and related activities.

The 1966 copy of the New York Statewide Comprehensive Outdoor Recreation Plan (46) lists the following action programs applicable to the Great Lakes Basin:

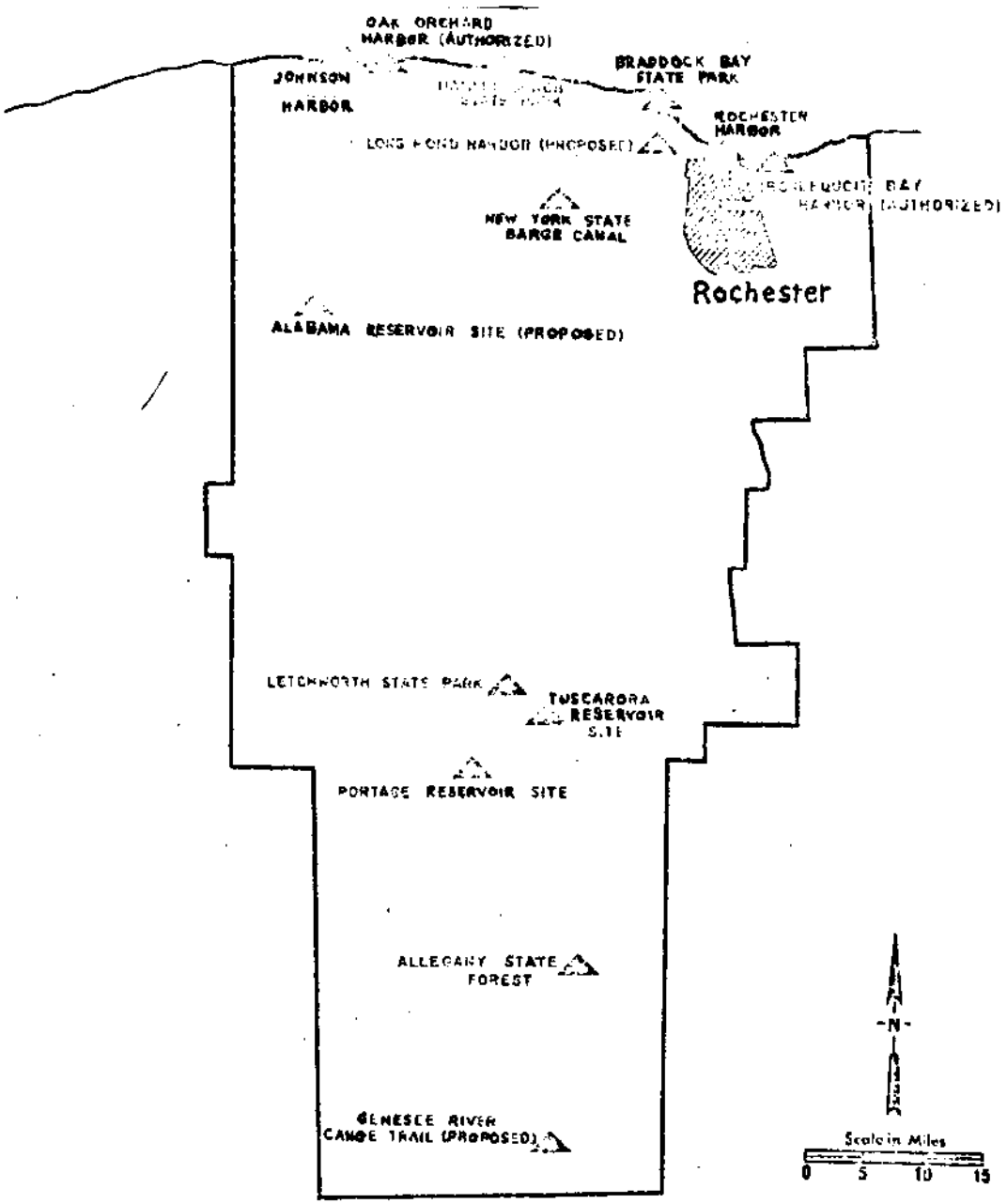
1. Programmed development in 14 state parks.
2. Programmed development in two county parks.
3. Programmed acquisition and development of six county parks.
4. Programmed acquisition of 12 county parks.
5. Programmed development of one multiple-use area.
6. Programmed development of one boat launching site.

Pennsylvania has programmed additional development for Presque Isle at Erie.

There are more than 47,000 acres of state forest lands in Cattaraugus and Chautaugua Counties. The development of one-half of one percent of these lands would provide an additonnal 240 acres of intensively developed and for recreational use. The 10,000 acres of game management and multiple in lands cound provide an additional 50 acres of intensively developed recreational lands.

Adequate public access should be provided to all existing lakes and streams. On Lake Erie additional harbors of refuge could provide better utilization of this water resource.

Subregion 5.1



Potential Programs to Satisfy Needs Subregion 5.1

In state and county parks larger than 500 acres, only about 800 acres out of a total of 24,000 acres have been developed for intensive recreational use. If 15 percent of these areas are ultimately developed for intensive use, an additional 2,800 acres could be made available.

In 1970, Allegany State Forest contained no recreational development. If we assume that one-half percent is developable for recreational use, this subarea could provide an additional 200 acres of intensive recreational development for such activities as camping, hiking, picnicking, and sightseeing.

The Recreational Appendix of the Genesee River Basin Study lists eight proposed reservoir sites in this Subarea:

1. Alabama site on Tonawanda Creek. The pool created by the dike would be about 1,250 acres and would be fluctuated to benefit waterfowl management programs.
2. Sierks site on Tonawanda Creek. The conservation pool surface would amount to 780 acres.
3. Angelica site on Black and Angelica Creeks near Letchworth State Park. The conservation pool surface area would amount to 900 acres.
4. Portage site on the Genesee River above Letchworth State Park. This impoundment would have a rather large conservation pool of 4,100 acres.
5. Tuscarora site on Kehequa Creek. A conservation pool of 660 acres would be included in the development of this site.

6. Oatha site on Oatha Creek in Genesee County. This site would contain a conservation pool of 640 acres.
7. Poog's Hole on Canoseroga Creek in Livingston County. This site would have a small conservation pool of 380 acres.
8. A reservoir site on two small tributaries of the Buffalo River.

The Genesee plan also recommended the construction of 11 Soil Conservation Service structures on small watersheds. A number of access sites were picked for development on the New York State Barge Canal and the principal stream. Four small boat harbors were proposed for development on Lake Ontario.

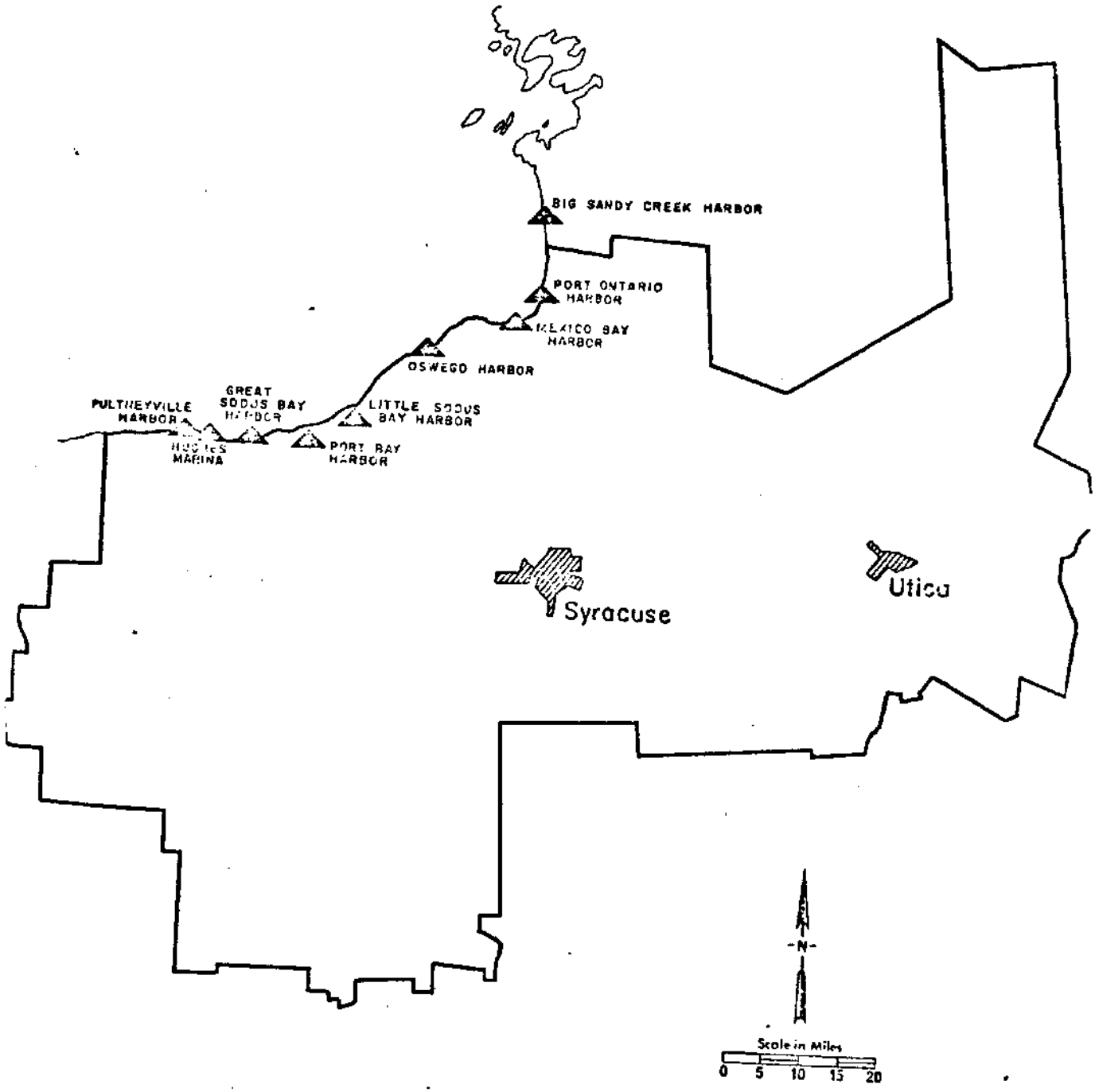
A stretch of the Genesee River in Allegany county was proposed for a canoe trail. The Finger Lakes trail was proposed to cross Allegany and Wyoming Counties.

The North Country Trail may eventually pass through the Subarea. This trail, plus any spur trails that may be developed, would help satisfy some of the needs for hiking and related activities."

"Potential Programs to Satisfy Needs Subregion 5.2

If most of the needs are to be met in this subarea, development of existing recreation lands and acquisition and development of new lands wil be necessary. New areas with the greatest natural qualities for recreational development occur along floodplains of the larger streams, on lake shores--especially inland lake shores--and the rugged and forested Appalachian Plateau.

Subregion 5.2



The numerous lakes in this subarea should be examined for their potential to qualify as scenic lakes and/or to provide additional recreational opportunities. Those lakes that qualify as scenic lakes should be protected and maintained in their natural state in the same manner as wild or scenic rivers which are presently being evaluated and established. The remaining lakes including adequate adjacent land should be developed to their optimal level of satisfying recreational needs where such facility development is feasible.

The North Country Trail may eventually pass through the subarea. This trail, plus any spur trails that may be developed, would help satisfy some of the needs for hiking and related activities.

According to the International Joint Commission beach study, (33) all beach areas along Lake Ontario in this subarea are available to the public; many of them are in public ownership. Thus, acquisition of lands for recreational development on Lake Ontario may require construction of new beach areas if swimming opportunities are to be provided.

The Hector Land Use Area is federal land which is located in the center of the Finger Lakes Region. It is managed under the principle of multiple-use by the U. S. Forest Service. It has major qualities and use as a recreation area on a year-round basis. This ranges from summer camping to winter snowmobiling. Emphasis has been placed on dispersed recreation such as hunting, hiking, snowmobiling, and primitive camping. This is in order to complement intensively developed recreational facilities along the surrounding lakes. One developed campground has been established and more are

planned. Included in the 14-mile trail system is a section of the Finger Lakes Trail. Hunting, fishing, and wildlife study are enhanced by some 20 small man-made water impoundments. This federal area has excellent potential for meeting recreation requirements in the Finger Lakes area.

The 1966 Statewide Comprehensive Outdoor Recreation Plan for New York shows that 15 state parks in the subarea were programmed for development. Five county parks were programmed for acquisition and development, and four for development only. In addition to these parks, three multiple-use study areas were also programmed for the subarea.

There are nine existing or potential harbors of refuge for use by small craft on Lake Ontario in this subarea. They include:

1. Pultneyville Harbor--study deferred pending receipt of agreement for local cooperation.
2. Hughes Marina--a private harbor two miles east of Pultneyville; no Federal plans.
3. Great Sodus Bay Harbor--existing Federal deep draft harbor.
4. Port Bay Harbor--authorized Federal small boat harbor; study deferred pending receipt of agreement for local cooperation.
5. Little Sodus Bay Harbor--existing Federal deep draft harbor; no commerce for several years; currently being maintained as a small boat harbor.
6. Oswego Harbor--existing Federal deep draft harbor.

7. Big Sandy Creek Harbor--no Federal plans.
8. Mexico Bay Harbor--small boat harbor; study authorized, but not yet started.
9. Port Ontario Harbor--authorized Federal small boat harbor; further study not yet underway.

State game management areas, especially the larger one, present an excellent opportunity for the development of limited remote camping sites and related activities. Such areas should have only minimal development and available activities should include only those that are compatible with the basic purpose of these areas.

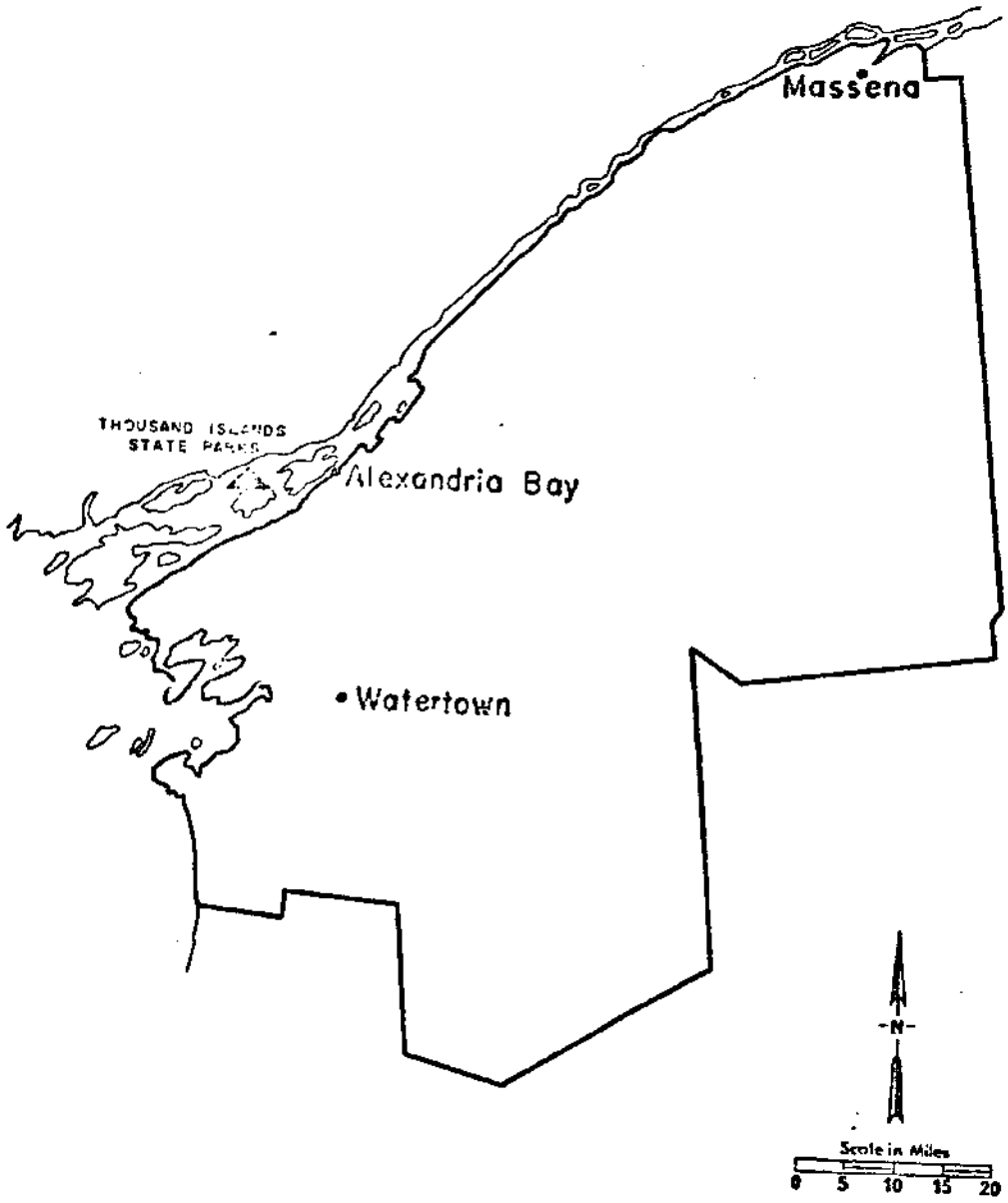
In this subarea there are nearly 40,000 acres of land in game management areas. At a one percent level of development, this land could provide 400 of land for development with recreational facilities. Activities should be limited to remote camping, picnicking, boating where water is available, and wildlife observation and photography.

Nearly 130,000 acres are managed as state forest lands. They include about 300 acres of wetland and 275 acres of water surface. These lands can provide substantial opportunities for the development of recreation areas oriented toward the extensively developed remote type activities, including camping, picnicking, hiking, nature study and photography, and boating where water is available. If one-half of one percent of the state forest lands were developed for recreational use, about 650 acres of additional recreation lands would become available.

Additional recreation opportunities for future time frames should be provided by the acquisition and development of new parks on lakeshores and streams. These areas should be strategically located with respect to urban areas.

The private sector also has considerable potential for quality recreational development. With encouragement, this sector of the economy could help satisfy a portion of the subarea's recreational needs.

Subregion 5.3



Potential Programs to Satisfy Needs Subregion 5.3

The largest acreage which has potential for recreational development is found in the several reforestation areas of the subarea. Over 153,000 acres of these lands are virtually undeveloped for recreational use. Similarly, several public parks contain sufficient buffer lands for increased development without seriously damaging the aesthetic qualities of the area.

Some additional lands will also need to be acquired and developed to meet the ever increasing need for recreational opportunities in this subarea. An increasing number of people from the New York metropolitan area are looking to the Adirondack area for recreational opportunities. It is believed that if good data on directional patterns of travel were available for use in the analysis of requirements, supply, and needs, the surplus presently shown for camping and picnicking would rapidly become a deficit.

Where they are suitable for recreational use, floodplains and adjacent lands should be acquired and developed, especially near urban areas. These can provide a full range of day-use and many weekend-use types of activities. If suitable tracts of land of sufficient size are available , they should be acquired and developed to their optimal potential.

Once land acquisition has been completed, the development of single or multiple-purpose reservoirs can become another potential program for satisfying needs.

The numerous lakes in this subarea should be examined for their potential to qualify as scenic lakes. These lakes that qualify should

be protected and maintained in their natural state in the same manner as wild or scenic rivers which are presently being evaluated and established. Where additional potential for the development of recreational facilities is feasible on lakes not justifying as scenic lakes, that potential should be expanded to the optimal land.

Other recreational opportunities can be provided by acquisition and development of access sites on streams and Lake Ontario where present recreational development is inadequate. Additional harbors of refuge and marinas should be considered for the Lake Ontario shore.

The 1966 New York State Comprehensive Outdoor Recreational Plan (46) indicates programmed development of the following within this planning subarea:

1. Fifteen state parks, concentrated along Lake Ontario and the St. Lawrence River Valley.
2. Five state campsites.
3. Four boat launching sites.
4. Two harbors of refuge.
5. Four wetlands.

If encouraged, the private sector can help meet the needs of this subarea. It can certainly provide quality development for certain activities such as camping, golfing, and boat launching."

Table 1. Recreational Requirements in Acres or Miles for Subregions in Southern Lake Ontario Basin for 1970, 1980, 2000, and 2020 (in 1000's)

	1970				1980				2000				2020			
Activity	4.4	5.1	5.2	5.3	4.4	5.1	5.2	5.3	4.4	5.1	5.2	5.3	4.4	5.1	5.2	5.3
Land-Based Warer-Oriented																
Swimming	200	110	180	40	280	160	260	60	430	250	400	100	600	350	570	140
Picnicking	1,190	640	1,000	600	1,440	790	1,230	750	1,920	1,080	1,680	1,000	2,560	1,450	2,270	1,330
Camping	820	400	580	230	1,250	620	910	360	1,980	1,000	1,490	570	3,000	1,550	2,310	870
Hiking	180	150	270	220	280	240	370	180	420	370	580	280	590	530	840	400
Nature Trails	20	20	20	10	20	20	30	10	30	30	40	10	40	30	50	10
Land-Based General Outdoor Games	2,360	1,140	3,170	1,550	3,420	1,620	4,650	2,250	5,620	2,540	7,710	3,680	29,340	13,100	11,760	18,160
Golf	3,840	3,300	5,020	1,240	5,520	4,780	7,300	1,780	9,160	8,100	12,440	2,980	13,100	11,760	18,160	4,280
Bicycling	380	320	480	120	450	380	570	140	590	510	760	190	700	680	1,040	250
Horseback Riding	90	80	120	30	110	100	150	40	160	140	220	50	220	200	310	70
Water Surface																
Boating	35	30	47	29	49	43	69	42	77	68	109	65	113	100	164	96
Sailing	2	2	0	0	3	3	0	0	5	4	0	0	7	7	0	0
Canoeing																
Lakes	2	1	2	1	2	2	3	1	4	3	5	2	5	5	7	2
Streams	200	175	275	75	300	250	400	100	450	400	625	150	625	575	875	200
Water Skiing	12	10	15	4	21	18	26	6	37	31	46	11	58	52	78	18
Winter Sports																
Skiing	340	290	450	110	360	310	480	120	430	380	600	150	530	480	750	180
Sledding	420	360	560	140	520	450	710	170	800	720	1,130	270	1,220	1,100	1,760	410
Ice Skating	30	30	40	10	50	40	70	20	70	70	110	30	120	110	160	40

APPENDIX B

Extracted from Kalter et al. 1970.
"Outdoor Recreation: Projections for 1970-1985"

Eight regions in New York State (Figure 1) were surveyed for 1960 and 1965, recreation demands for five activity categories. Projections of recreation demand for these activities are presented in Table 1.

Table 1. Projected Recreation Demand for Five Activities During Summer of 1985 for New York O.P.C. Regions. (1000's of visitors days)

Occasion	Central New York Region				Ontario Region				Mohawk Region				Southern Tier East Region			
	Based on eqns. from nonaggr. data		Based on eqns. from aggr. data		Based on eqns. from nonaggr. data		Based on eqns. from aggr. data		Based on eqns. from nonaggr. data		Based on eqns. from aggr. data		Based on eqns. from nonaggr. data		Based on eqns. from aggr. data	
	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965
Camping																
Overall†	238	269	342	373	340	372	484	515	132	146	190	199	171	192	245	265
Vacation	135	149	153	213	192	202	212	290	75	80	85	111	97	106	109	151
Trip	103	120	189	160	148	170	272	225	57	66	105	88	74	86	136	114
Boating																
Overall†	903	719	1,279	1,118	1,247	1,001	1,762	1,524	481	391	696	600	562	449	796	701
Vacation	321	278	449	456	442	385	614	623	168	151	237	240	198	173	275	284
Trip	243	237	332	291	332	338	463	400	133	130	178	163	151	149	207	186
Outing	339	204	498	371	473	278	685	501	180	110	275	197	213	127	314	231
Hiking																
Overall†	290	172	331	202	385	236	422	275	147	92	174	105	190	115	222	134
Vacation	93	96	106	115	121	134	146	159	47	52	56	62	56	64	70	77
Trip	42	34	*	*	56	46	*	*	22	18	*	*	28	23	*	*
Outing	155	42	*	57	208	56	*	76	78	22	*	29	106	28	*	37
Fishing																
Overall†	782	680	1,197	1,045	1,113	973	1,759	1,479	449	389	680	593	536	453	818	717
Vacation	289	247	381	333	405	347	541	468	164	139	216	188	196	162	258	226
Trip	200	212	318	282	292	315	484	422	117	125	177	165	140	147	218	196
Outing	293	221	498	430	416	311	734	589	168	125	287	240	200	144	343	295
Swimming																
Overall†	2,854	2,173	4,153	3,659	3,923	2,965	5,708	4,983	1,540	1,167	2,210	1,925	1,810	1,377	2,605	2,296
Vacation	1,060	939	1,516	1,429	1,456	1,286	2,043	1,997	565	503	807	751	668	593	964	880
Trip	403	373	580	508	555	518	857	697	218	202	305	280	254	237	342	323
Outing	1,391	861	2,057	1,722	1,912	1,161	2,808	2,289	757	462	1,098	894	888	547	1,299	1,093

From Kalter et al. (1970)

Table 1. (Cont'd)

Occasion	Based on eqns. from nonregr. data		Based on eqns. from regr. data		Based on eqns. from nonregr. data		Based on eqns. from regr. data		Based on eqns. from nonregr. data		Based on eqns. from regr. data		Based on eqns from nonregr. data		Based on eqns from regr. data	
	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965	1960	1965
	Long Island Region				New York City Region				Western Region				Southern Tier West Region			
	Camping															
Overall†	996	1,074	1,429	1,482	730	784	1,047	1,088	366	395	517	546	148	165	212	227
Vacation	558	580	619	822	414	416	450	595	205	213	226	305	84	91	95	128
Trip	438	494	810	660	316	368	597	493	161	182	291	241	64	74	117	99
	Boating															
Overall†	4,245	3,381	5,991	5,149	6,944	5,585	9,614	7,648	1,459	1,196	2,086	1,762	482	391	691	603
Vacation	1,549	1,294	2,169	2,051	2,462	2,139	3,494	3,295	522	460	727	736	169	151	236	244
Trip	1,100	1,174	1,566	1,436	1,876	1,909	2,541	1,807	400	403	550	442	134	128	179	159
Outing	1,596	913	2,256	1,662	2,606	1,537	3,579	2,546	537	333	809	584	179	112	276	200
	Hiking															
Overall†	1,227	729	1,240	855	2,279	1,446	2,103	1,706	410	266	453	311	159	100	195	115
Vacation	439	422	478	506	701	831	926	997	144	151	164	180	49	56	61	67
Trip	169	139	*	*	338	278	*	*	64	52	*	*	25	20	*	*
Outing	619	168	*	226	1,240	337	*	474	202	63	*	87	85	24	*	33
	Fishing															
Overall†	3,426	3,155	5,480	4,520	5,018	4,417	8,475	6,531	1,283	1,151	2,061	1,693	487	413	737	648
Vacation	1,260	1,135	1,717	1,428	1,880	1,558	2,546	2,142	472	412	625	541	178	148	234	206
Trip	911	997	1,518	1,373	1,221	1,482	2,420	1,994	327	366	573	487	125	133	192	175
Outing	1,255	1,023	2,245	1,719	1,917	1,377	3,509	2,395	484	373	763	665	184	132	311	267
	Swimming															
Overall†	11,947	8,872	17,420	14,841	27,806	20,872	44,519	37,189	4,651	3,524	6,907	6,011	1,564	1,192	2,253	1,983
Vacation	4,494	3,900	6,181	6,134	10,509	9,232	13,493	17,470	1,728	1,532	2,372	2,511	574	512	826	766
Trip	1,709	1,569	2,751	2,148	4,073	3,727	10,960	4,872	663	618	1,194	821	220	205	306	282
Outing	5,744	3,403	8,488	6,559	13,224	7,913	20,066	14,847	2,260	1,374	3,341	2,679	770	475	1,121	935
	St. Lawrence Region				Lake George-Champlain Region				Upper Hudson Region				Mid-Hudson Region			
	Camping															
Overall†	86	96	122	133	70	80	101	109	265	294	382	407	718	772	1,026	1,078
Vacation	49	53	55	76	40	44	45	62	150	161	169	229	403	416	441	599
Trip	37	43	67	57	30	36	56	47	115	133	213	178	315	356	585	479
	Boating															
Overall†	269	217	383	337	218	175	309	272	963	774	1,369	1,186	2,835	2,255	3,978	3,359
Vacation	93	84	129	139	76	68	106	112	340	299	474	482	1,032	864	1,434	1,373
Trip	74	71	100	86	60	57	80	70	260	258	358	312	734	781	1,056	885
Outing	102	62	154	112	82	50	123	90	363	217	537	392	1,069	610	1,488	1,101
	Hiking															
Overall†	97	60	119	69	77	49	94	56	307	188	348	217	844	520	853	614
Vacation	28	33	35	39	22	27	29	32	97	106	116	126	274	300	337	358
Trip	15	12	*	*	12	10	*	*	45	37	*	*	121	99	*	*
Outing	54	15	*	20	43	12	*	16	165	45	*	61	449	121	*	165
	Fishing															
Overall†	267	223	404	358	229	191	347	307	867	753	1,344	1,150	2,366	2,089	3,879	3,111
Vacation	97	80	126	113	83	68	108	97	317	270	420	365	875	741	1,184	991
Trip	69	72	107	94	59	62	93	81	225	241	360	321	617	689	1,095	941
Outing	101	71	171	151	87	61	146	129	325	242	564	464	874	659	1,600	1,179
	Swimming															
Overall†	875	672	1,257	1,122	713	546	1,031	912	3,057	2,318	4,431	3,879	8,886	6,636	13,196	11,308
Vacation	320	287	465	424	262	234	378	352	1,130	1,002	1,602	1,531	3,349	2,921	4,537	4,787
Trip	122	115	163	156	100	94	140	127	432	402	640	547	1,274	1,174	2,312	1,570
Outing	433	270	629	542	351	218	513	433	1,495	914	2,189	1,801	4,263	2,541	6,347	4,951

*Insufficient sample size to aggregate.
†The overall category is sum of vacation, trip, and outing categories and not estimated separately from overall activity equation, except for aggregated hiking

Figure 1. O.P.C. Regions in New York

From Kalter et al. (1970)

Recreation

APPENDIX C

These and other forthcoming studies are being published in widely circulated journals, but are presently available only through interlibrary loan from the Canada Department of Indian Affairs and Northern Development Library, Ottawa, Ontario.

Author	Title	CORD Design Task No.
J.L. Knetsch	A Design for Assessing Outdoor Recreation Demand in Canada	
Traveldata Ltd. of Canada	Park Visits and Outdoor Activities of Canadians Fall 1971	1
Traveldata Ltd. of Canada	A Study of Outdoor Recreation Habits of Canadians in 1968	1
Traveldata Ltd. of Canada	A Study of OUtdoor Recreation Habits of Canadians in 1969	1
Ben Crow & Assoc. Ltd.	A Preliminary Study of the Motivational Factors Relevant to Outdoor Recreation	2
Ben Crow & Assoc. Ltd.	Volume I: A Study of Activities of Campers - 1968	2
Ben Crow & Assoc. Ltd.	Volume II: A Study of Leisure Activities in Canada - 1968	2
Ben Crow & Assoc. Ltd.	Volume III: A Study of Leisure Needs in Canada - 1968	2
Ben Crow & Assoc. Ltd.	Volume IV: A Study of Leisure Needs and Leisure Activities of Canadians - 1968	2

Ben Crow & Assoc. Ltd.	Leisure Time, Parks and Tourism in Canada - 1968	2
	(a) Moncton	
	(b) Winnipeg	2
J. C. Keicester and J. Beaman, D. H. Elliot, J. M. Beauchesne and A.J.O. Farina	Sociologists' Assessment of (Ben Crow) Leisure Time Studies	2
Ontario Dept. of Lands and Forests, Parks Branch	Facility Inventory Atlas File	6,7
Ontario Dept. of Lands & Forests, Parks Branch	1969 Park User Survey	11
T. J. Kovacs	Self-Administered Park Survey Technique: A Working Paper on the Canadian Outdoor Recreation Demand Study Survey Methodology	10,11
Canadian Facts Co. Ltd.	U.S. Automobile Exit Study, Summer 1968. Volumes I & II	13
Canadian Facts Co. Ltd.	Summary of U.S. Automobile Visitors to Canada, Summer 1967 and 1968	13
P. Klopchic	Analysis of Auto Exit Studies	13
P.A. Ellis	A Study of Outdoor Recreation Habits of Canadians in 1969. Report No. 1	14
R. Vrancart	C.O.R.D. Canadian Participation in Outdoor Recreation 1967, 1968, 1969	14
J.L. Knetsch	Working Paper. Outline of Data Analysis Assessing Outdoor Recreation Demands in Canada	14,15
H.K. Cheung	A Day-Use Visitation Model: Working Paper Progress Report in the Canadian Outdoor Recreation Demand Study	15

D. Lockwood — Canadian Outdoor Recreation Study - Progress Report - 1969

D. Lockwood — Canadian Outdoor Recreation Demand Study Progress Report. 1970

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Wildlife

APPENDIX A

Characteristics of Wildlife Resource of the New York Portion of the Lake Ontario Basin

From Great Lakes Basin Framework Study No. 17

2.1.8 New York

Wildlife density and status for the New York portion of Area 4.4 and Areas 5.1, 5.2 and 5.3 is noted in Tables 17-20, 17-21, 17-22 and 17-23, respectively. A good diversity of habitat exists across the New York portion of the Basin. This diversity makes it possible for a greater variety of wildlife to exist as well as making the habitat more productive.

Wildlife habitat in Area 4.4 is mostly the farm game type located along the lake plain and hill country extending northeast from the Pennsylvania line to the Lake Ontario shore. This land supports medium densities of most farm game species except the mourning dove which is low.

High quality upland forest habitat is found in the southeast corner of the area. Medium deer densities and occasional bear and turkey (increasing) are indicators of the habitat value. However, ruffed grouse populations are low here in contrast to the highs elsewhere in the Great Lakes Basin.

The Niagara River is an important waterfowl loafing and feeding area during migration. Scattered small wetlands are found mostly near the Lake Ontario shore, but none are of great waterfowl importance.

Area 5.1 is equally divided into forested uplands (southern half) and agriculturalized lowlands (northern half). The lowland portion contains numerous wetlands in lake shore bays and inland.

Forest game populations in the southern half of the area including deer, bear, turkey and snowshoe-hare are of low to medium density with turkey increasing. Although high quality forest habitat exists here the bobcat is lacking.

Farm game is doing well in the lowland portion of the area with high pheasant populations and medium populations of cottontail rabbits, mourning doves and squirrels. Woodcock are also of medium density. High pheasant populations are unusual in the Basin and may indicate that changes in farming practices which are detrimental to habitat have not occurred here as extensively as they have elsewhere.

Most furbearers occur at medium densities in the shore marshes and the inland river associated marshes and streams.

To the east is 5.2, a large sprawling area which encompasses a wide variety of habitat types including agricultural lands, small woodlots, idle farmlands, estaurine marshes, marshy stream bottoms, lake associated marshes, wooded river bottoms, intermediate and mature forests. A broad urban belt bisects the area from east to west and expansion of the zone is diminishing wildlife habitat. However, idle farmland is more common in the vicinity of urban areas and due to its value as wildlife habitat the increases in this acreage partially compensate for habitat losses.

A greater diversity of wildlife species exists here due to the variety of habitat types. Forest game populations in the eastern and southe portions of the area are at low to medium densities. Bears occur only occasionally which is probably due to the proximity of humans. Bobcats are also found in low numbers in the forested portions of the area. Since these cats are moderately tolerant of human intrusion, their presence or absence is tied to adequate second growth hardwood and coniferous forests. Rodent and other small mammal populations are important to bobcats,

but are probably not a limiting factor here. Martens are occasionally seen in the area's coniferous forests. Deer are at medium density and turkeys are low but are increasing. Other resident forest wildlife species include snowshow hare, ruffed grouse, squirrels and porcupines. The farm game species, rabbits, pheasant and mourning dove are doing well and the woodcock is at medium density. Furbearers are also thriving with a high muskrat population, medium mink, weasel, beaver, raccoon, skunk and opossum populations with only the otter at a low level. The area's plentiful wetland habitat is important to most furbearers as well as waterfowl. It is also important to the occasionally seen bald eagles.

Area 5.3 is the most complex region of the New York portion of the Great Lakes Basin. It includes a large part of the Adirondack Forest Preserve as well as a portion of the St. Lawrence river island complex. Wildlife status and density figures are shown by zones (eight in all) since so much difference in habitat types exist across the area (Table 17-23 and Figure 17-2).

Forest game populations vary. Deer range from low to high, bear from low to high, turkey from absent to low, and ruffed grouse from low to high. The more rare forest species such as bobcat, marten, fisher and spruce grouse range from absent to low. However, the fisher populations range from medium to high in the three Adirondack zones shown in Figure 17-2.

Furbearers are generally of medium density throughout the Area with some species at high levels in most zones. Mink and muskrat are commonly at high levels in the area. The otter is also high in the western and central Adirondack zones which indicates high quality stream habitat. The occurrence of other unusual wildlife species at healthy population levels is indicative of the high value of the wilderness habitat.

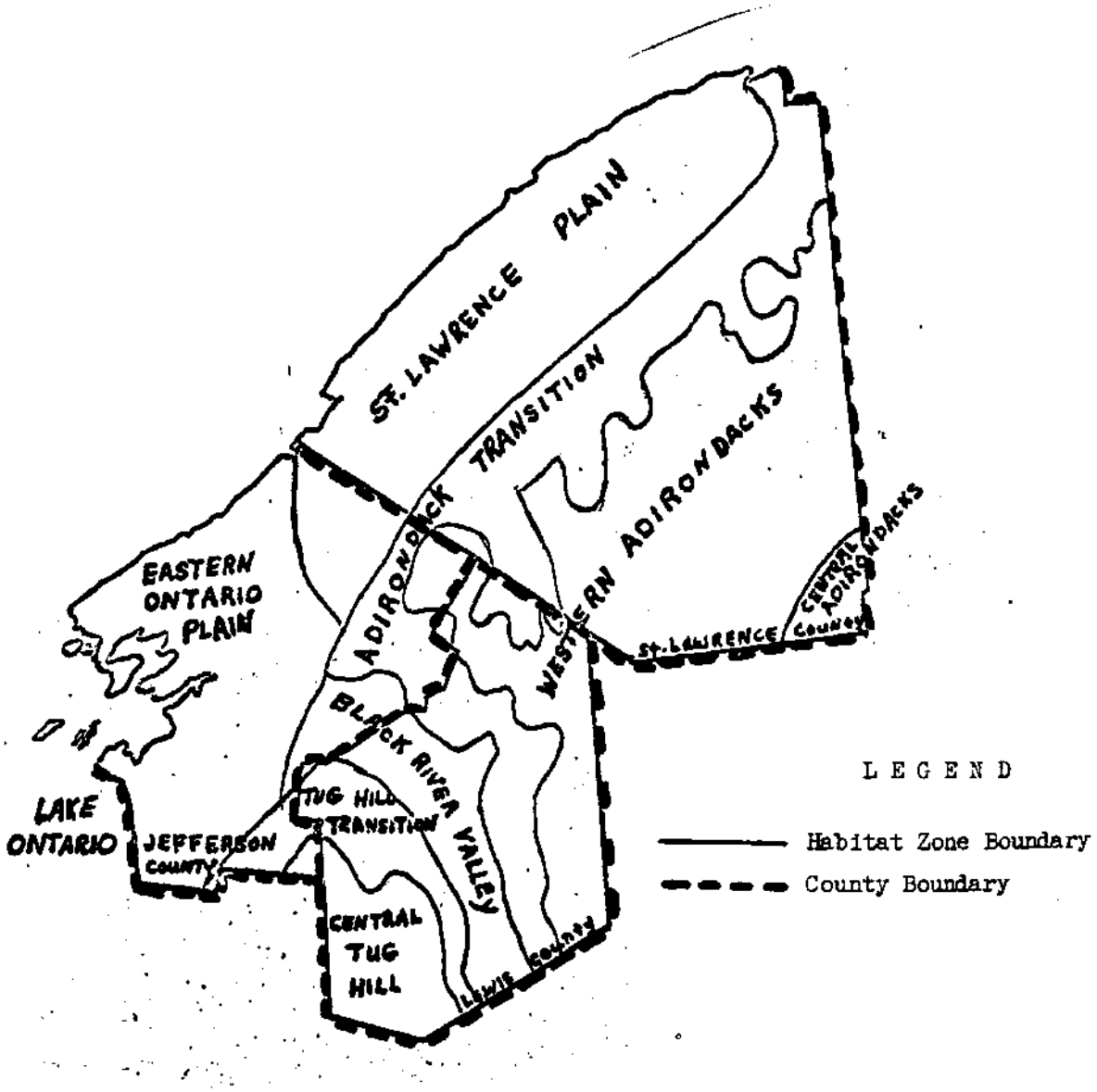


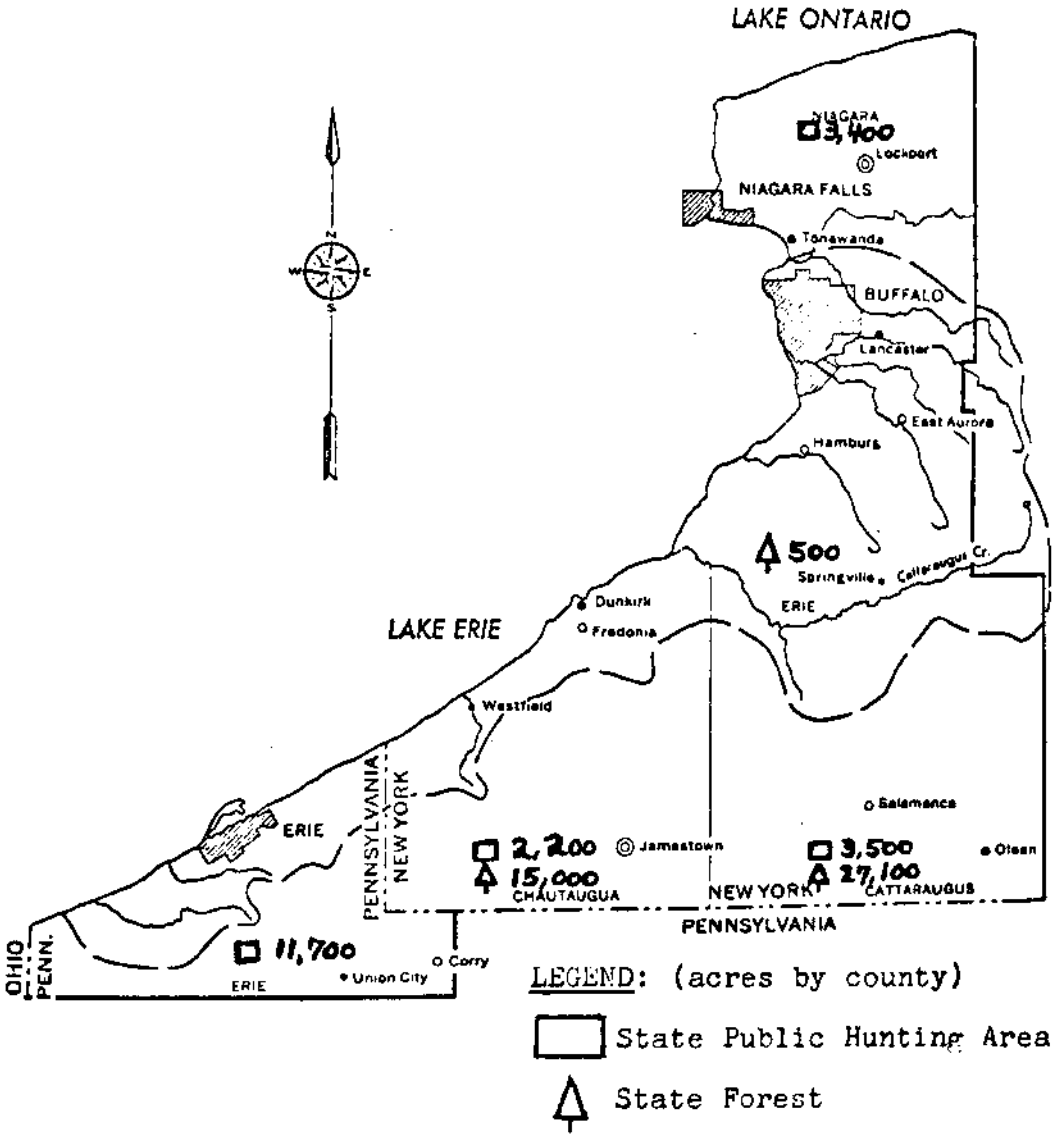
Figure 17 - WILDLIFE HABITAT ZONES, PLANNING SUBAREA 5.3, NEW YORK

One new and interesting species, the coyote, has become well established here adding more diversity to the fauna.

Although due to State policy, no management practices can be carried out in the Adirondack Forest Preserve, there is a benefit to some wilderness dwelling animals. If for instance, forestry practices were allowed, the marten and fisher populations would be drastically reduced.

Farm game habitat is not as plentiful as forest and forest transition habitat and this is reflected by less farm game. Cottontail rabbit, pheasant and mourning dove levels are generally low to medium in the lowland farms along the Ontario shore and absent in the forested mountain zones.

The marshes of the St. Lawrence River and other river valleys support high populations of ducks and geese. Large wetland acreages exist here serving as production areas as well as resting and feeding areas for migrating waterfowl.



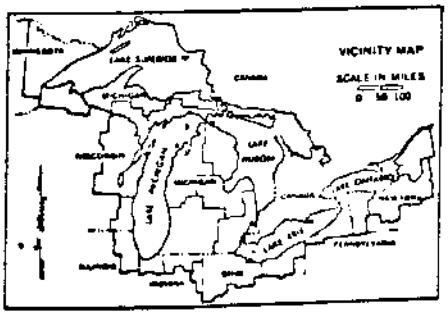


FIGURE 17-13, PUBLIC LANDS IN PLAN SUBAREA 4.4, 1970

SCALE IN MILES
0 5 15

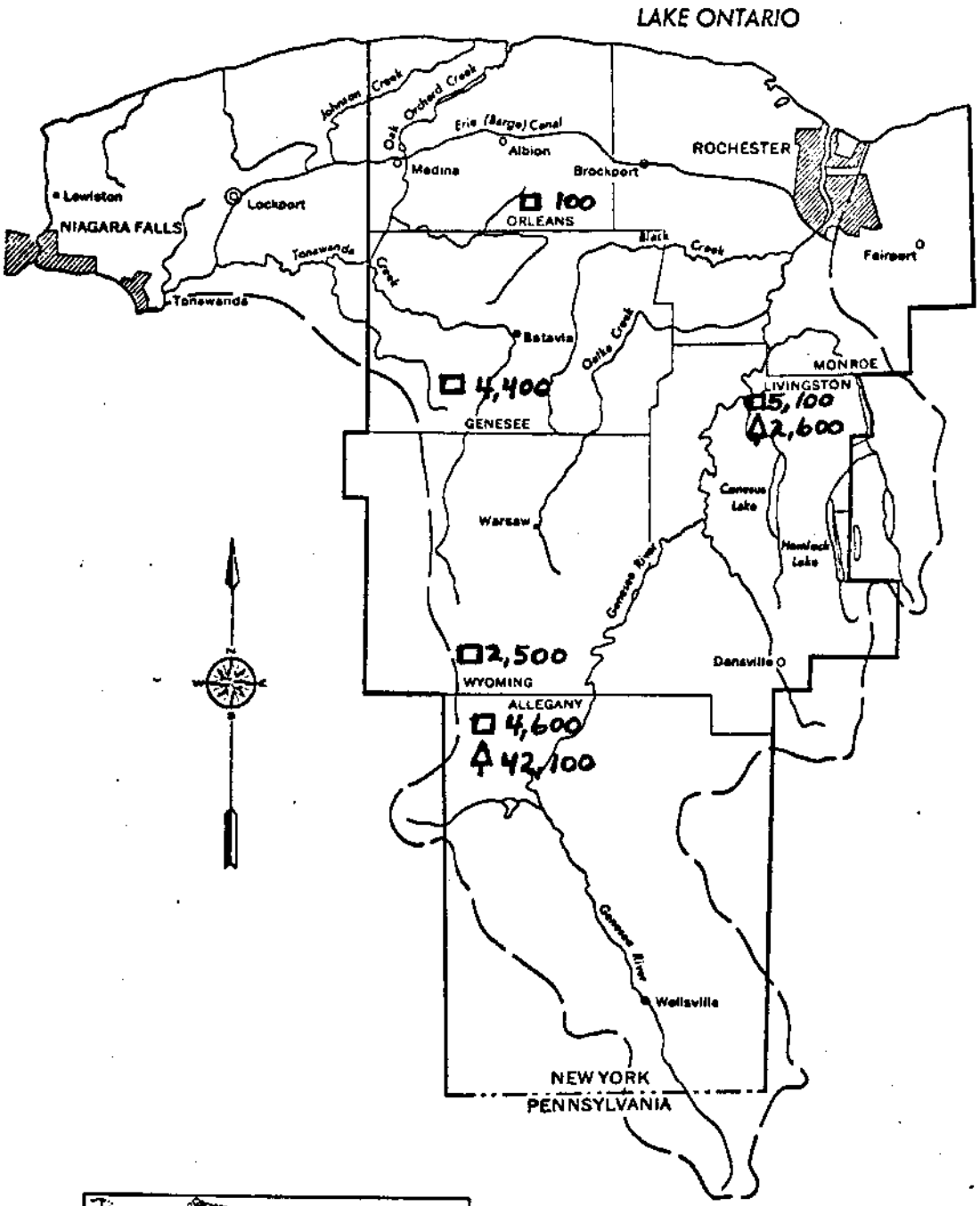


FIGURE 17-14, PUBLIC LANDS IN PLAN SUBAREA 5.1, 1970

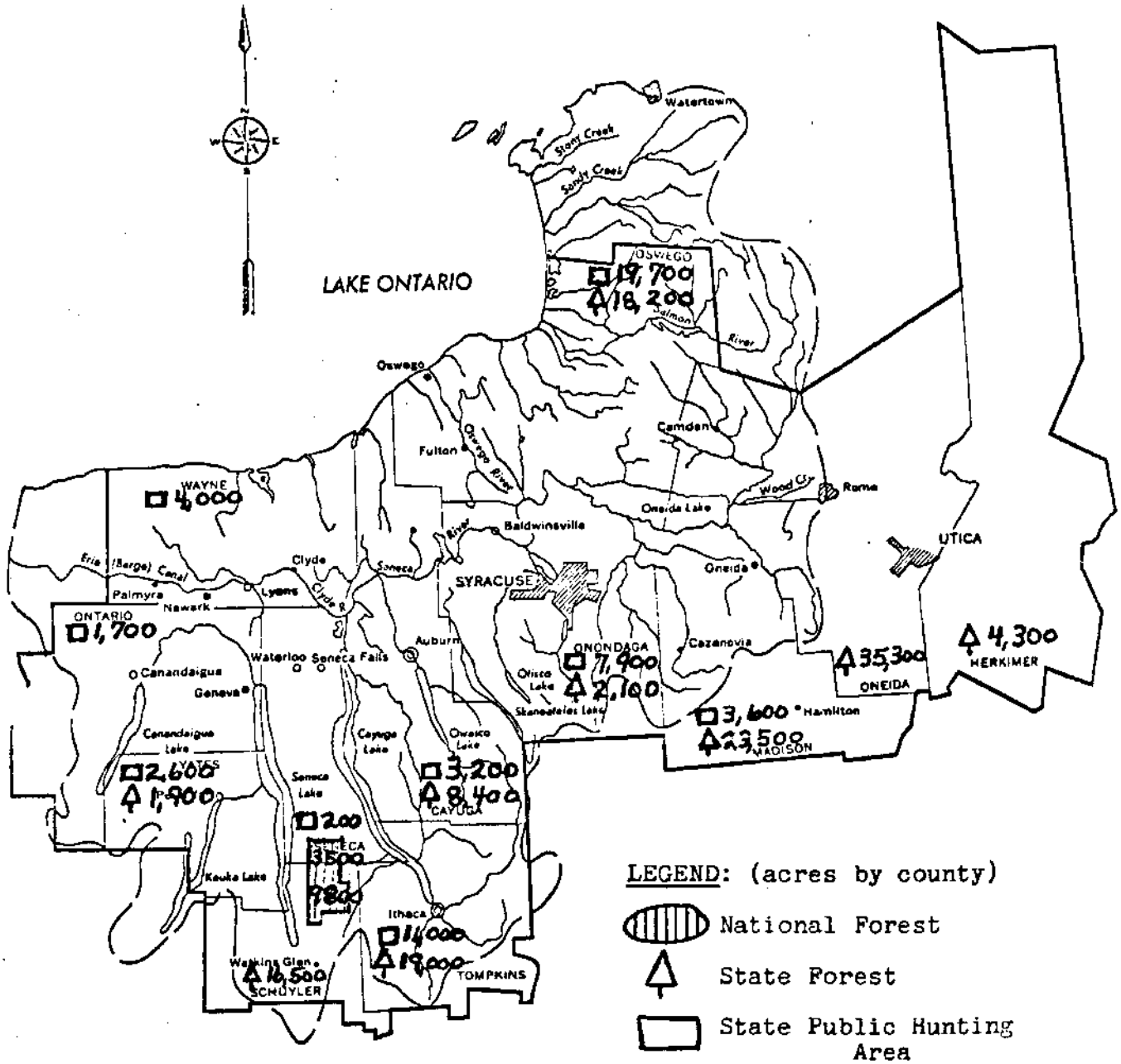
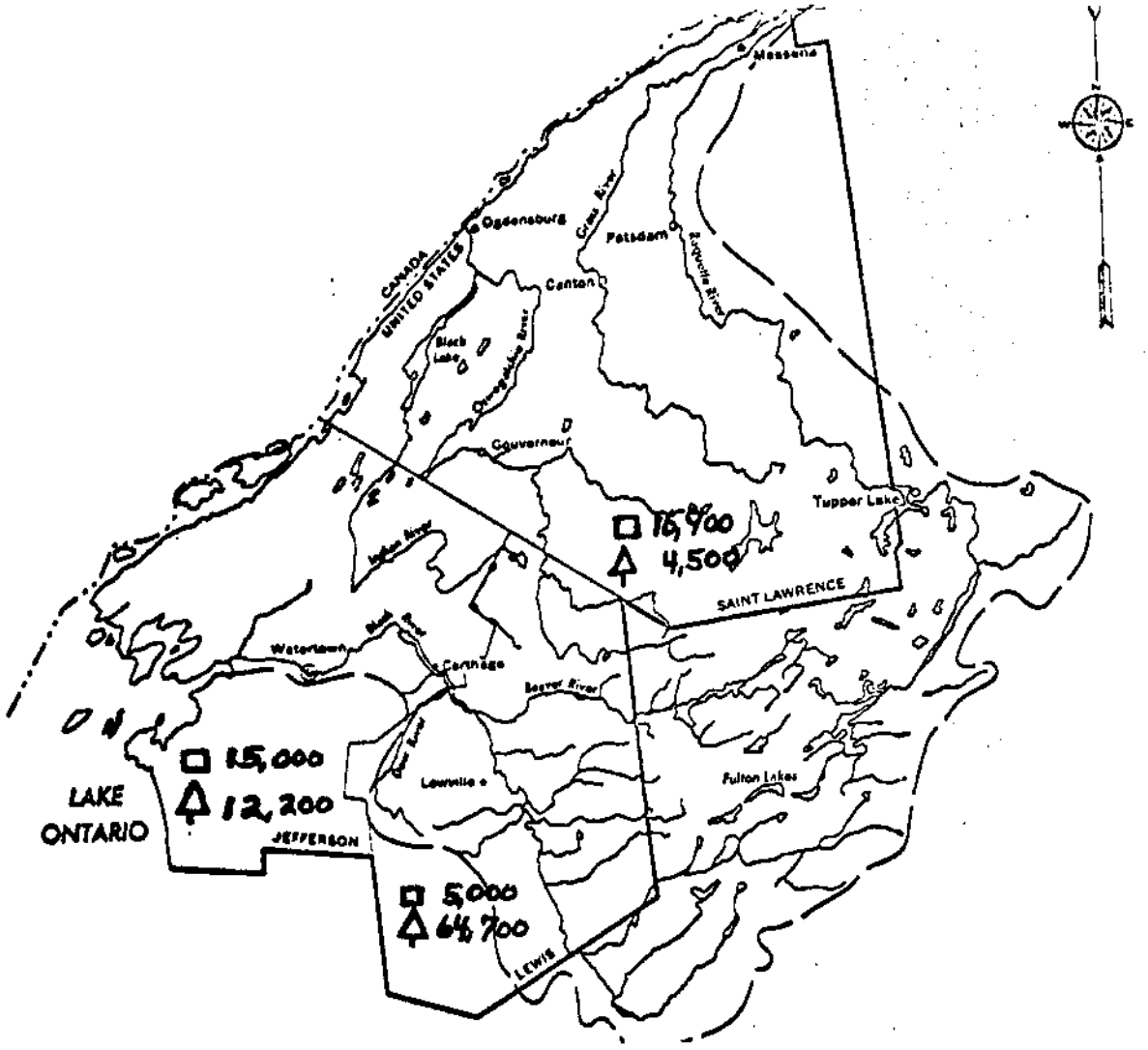


FIGURE 17-15, PUBLIC LANDS IN PLAN SUBAREA 5.2, 1970



LEGEND: (acres by county)

State Public Hunting Area

State Forest

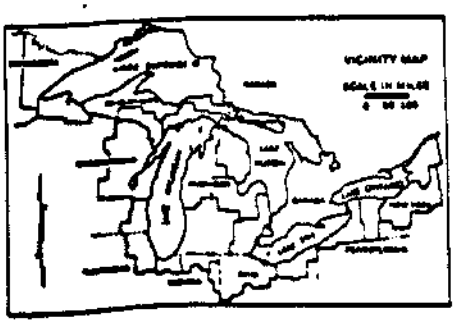


FIGURE 17-16, PUBLIC LANDS IN PLAN SUBAREA 5.3, 1970

SCALE IN MILES

Wildlife

APPENDIX B

Future Programs for the New York Portion of the Lake Ontario Basin

From Great Lakes Basin Framework Study No. 17

"The New York State Department of Environmental Conservation has plans for wildlife enhancement in the basin through 1976. These plans include the development of 6000 acres of wetlands for waterfoul production, purchase of 11,000 additional acres of wetland, provision of 170 miles of hunting access roads, and improvement of 11,000 acres of wildlife habitat."

Specific management recommendations for New York include (1) upgrading fish and game agency education programs to promote better wildlife user - landowner relationships; (2) purchase more public hunting land; (3) expand the "conservation cooperator" program for green belts and open space areas and strengthen the land zoning practice ; and (4) improve degraded waterways while enforcing strong pollution regulations and developing thorough monitoring systems. Wetlands and marshes must be protected against water level fluctuations and dredging-filling developments. The barge canal and its associated marshes are the most important wetlands in the southern portion of the basin. Shallow water areas and shoreline marshes throughout the basin should be put under the complete responsibility of government agencies. Modified farming practices, expanded wildlife extension programs offering technical assistance, and an increase in access agreements (or reduction in posted areas) are needed to improve the farm game and upland game resource. Deer hunting would be improved by controlling dog packs; insuring greater access to some areas, such as the Tug Hill zone; and increasing public owned land. Generally, enforcement of hunting and water pollution laws need stronger support. Some special recommendations for the St. Lawrence region are (1) liberalizing harvest limits in intensive use areas; (2) develop more public access spots to wetlands and wilderness areas; and (3) more protection for wintering deer herds, improve public relations on deer harvest, and increase wetland acquisitions and protection.

Nonconsumptive uses will probably increase rapidly and is currently estimated by G.L.B.F.S. 17 as at least equal to consumptive use. A longer season and greater user density is possible in non-consumptive recreation areas.

Projected Net Demand on Wildlife Habitat by Non-Consumptive Users

Plan Sub-area	1980 (1000,s)	2000 (1000,s)	2020 (1000,s)
4.4	169.2	262.3	331.0
5.1	83.8	161.2	240.7
5.2	138.3	293.8	461.1
5.3	23.2	36.3	53.6

1/ Net demand represents the unsatisfied demand - the amount that the desire (expressed here in man-days) to do something exceeds the opportunity necessary to meet this desire.